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ENGINEERING NEWS-RECORD

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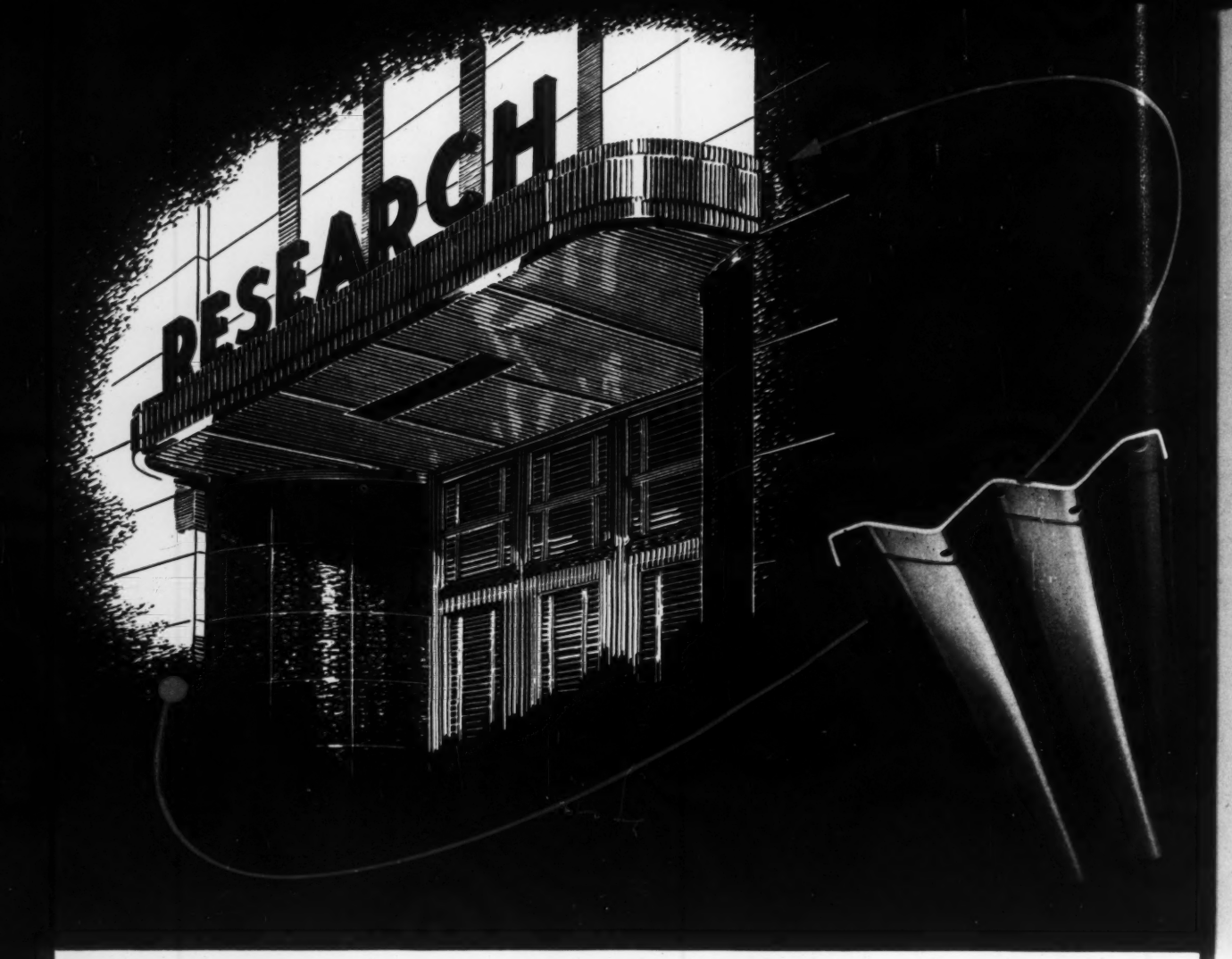

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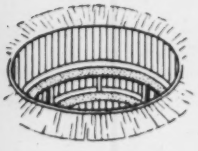
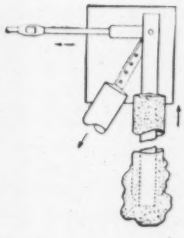
PROBLEM: To protect the upper section of steel H-piles from corrosion. WESTERN devised an economical method* of scouring the steel and encasing the upper 10 to 30 ft. of H-section in concrete after it has been driven as a pile. Encasing concrete is placed in the dry.



PROBLEM: To assure safety and facilitate work inside circular cofferdams. WESTERN eliminates all the usual cross bracing and "spiders," by use of reinforced concrete ring wales. The cofferdam is entirely open for operation of equipment and for building of the permanent structure. In one case a floating hydraulic dredge was placed inside the cofferdam to speed the excavating.

PROBLEM: To drive a large tip, cast-in-place pile longer than the leads. WESTERN is now driving its standard Button-Bottom Pile* to depths of 100 ft. or more with 90 ft. leads, thus preserving stability and mobility of equipment. An auxiliary section is added to the drive casing and the large button point (227 sq. in. compared with 50 sq. in. for an 8 in. pile tip) is driven to the deep bearing stratum.

PROBLEM: To provide a bulkhead of adequate strength where proximity of structures or sliding ground makes the usual buried anchorage impractical. For use with steel sheet pile bulkheads, WESTERN introduced a rigid A-Frame tie-back utilizing a vertical tension resisting Pedestal Pile in combination with a batter pipe or H-Beam compression pile. Pedestal Piles have been tested to 160 tons tension resistance.



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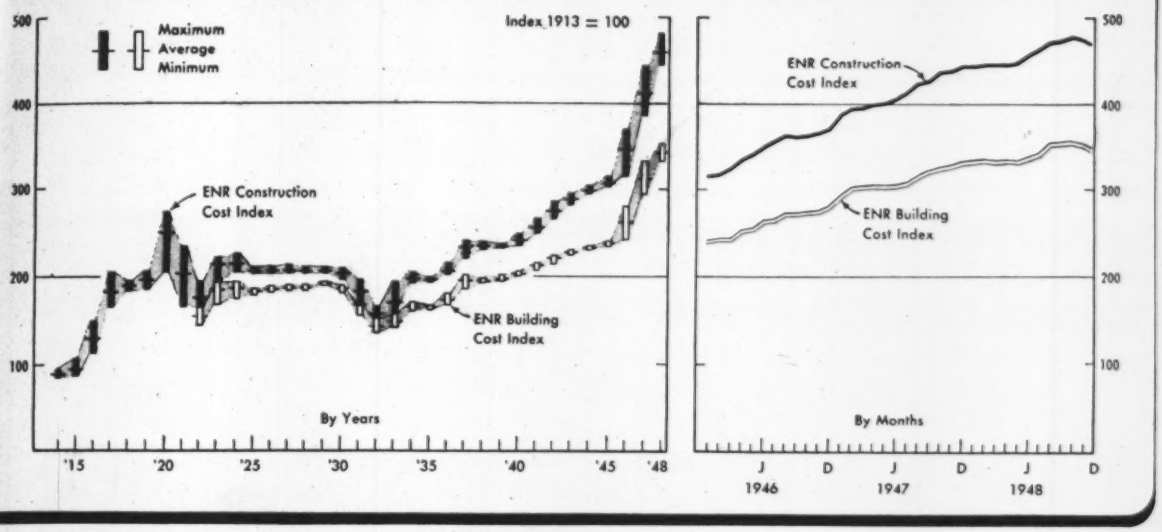
DECEMBER CONSTRUCTION BUSINESS REPORT

ENGINEERING NEWS-RECORD CONSTRUCTION AND BUILDING COST INDEX TRENDS



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	November 1947 (4 wk.)	November 1948 (4 wk.)	% Change	Eleven Months 1947 (48 wk.)	Eleven Months 1948 (48 wk.)	% Change
Total U. S. Construction	$474,357	$451,112	−5	$5,155,848	$6,375,843	+24
Private Construction	224,385	208,441	−7	2,895,434	3,075,545	+6
Public Construction	249,972	242,671	−3	2,260,414	3,300,298	+46
Federal	45,872	54,195	+18	569,749	879,485	+54
E. N. R. Construction Volume Index, 1913 = 100	234	203	−13	226	250	+11
Total New Productive Capital	$259,694	$528,814	+104	$3,104,293	$5,945,015	+92
Private Investment	259,694	528,814	+104	2,037,853	3,893,794	+91
Federal (non-federal work)	.....	.....	.....	247,711	492,289	+99
Federal (federal work)	.....	.....	.....	818,729	1,558,932	+90

CONSTRUCTION COST . . . . WAGE RATE . . . MATERIAL PRICES

1913 = 100	December 1947	December 1948	% Change	Change November to December 1947 Nov.	1947 Dec.	1947 %	1948 Nov.	1948 Dec.	1948 %
E N R Constr.-Cost Index†	441.13	477.66	+8.28	436.91	441.13	+0.97	478.25	477.66	−0.12
E N R Building Cost Index†	333.06	355.55	+6.75	329.22	333.06	+1.17	355.86	355.55	−0.09

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

	November 1947	November 1948	% Change	October 1948	% Change Oct. to Nov.
Common Labor	$1.272	$1.413	+11.08	$1.265	+0.55
Skilled Labor (Av. 3 Trades)	2.140	2.347	+9.67	2.125	+0.71
Bricklayers	2.303	2.554	+10.90	2.271	+1.41
Structural Ironworkers	2.146	2.332	+8.67	2.139	+0.33
Carpenters	1.970	2.177	+10.51	1.963	+0.36
Cement, bulk, per barrel	2.65	2.96	+11.70	2.65	0.0
Structural Steel, base	2.80	3.25	+16.07	2.80	0.0
Sand, per ton	1.842	2.042	+10.86	1.829	+0.71
Lumber, 2x4 Fir, per M ft.	97.00	95.61	−1.43	94.32	+2.84
Lumber, 2x4 Pine, per M ft.	88.79	82.82	−6.72	85.66	+3.65
Common brick, per M	24.288	27.338	+12.56	24.088	+0.83
Ready-mixed concrete, c.y.	9.394	10.207	+8.65	9.294	+1.08
Struct. clay tile, 3x12x12	121.09	128.40	+6.04	119.96	+0.94

	97.00	95.61	94.32	97.00	+2.84	97.00	95.61	−1.43
	88.79	82.82	85.66	88.79	+3.65	83.33	82.82	−0.61
	24.288	27.338	24.088	24.288	+0.83	27.338	27.338	0.0
	9.394	10.207	9.294	9.394	+1.08	10.164	10.207	+0.42
	121.09	128.40	119.96	121.09	+0.94	127.94	128.40	+0.36

	1947	1948	1947	1948	1948	1948	1948	1948
	$1.413	$1.413	$1.265	$1.272	+0.55	$1.413	$1.413	0.0
	2.347	2.347	2.125	2.140	+0.71	2.343	2.347	+0.17
	2.554	2.554	2.271	2.303	+1.41	2.554	2.554	0.0
	2.332	2.332	2.139	2.146	+0.33	2.322	2.332	+0.43
	2.177	2.177	1.963	1.970	+0.36	2.177	2.177	0.0
	2.96	2.96	2.65	2.65	0.0	2.95	2.96	+0.34
	3.25	3.25	2.80	2.80	0.0	3.25	3.25	0.0
	2.042	2.042	1.829	1.842	+0.71	2.042	2.042	0.0
	95.61	95.61	94.32	97.00	+2.84	97.00	95.61	−1.43
	82.82	82.82	85.66	88.79	+3.65	83.33	82.82	−0.61
	27.338	27.338	24.088	24.288	+0.83	27.338	27.338	0.0
	10.207	10.207	9.294	9.394	+1.08	10.164	10.207	+0.42
	128.40	128.40	119.96	121.09	+0.94	127.94	128.40	+0.36

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	November 1947	November 1948	% Change	Oct. 1948	% Change Oct. to Nov.
Steel (% operating Capacity) A.I.S.I., weekly average	96.6	99.2	+2.7	98.5	+0.7

	September 1947	September 1948	% Change	Nine Months 1947	Nine Months 1948	% Change
Cement, thous. bbl. U.S.B. of Mines	19,840	19,938	+0.5	138,187	153,153	+10.8

	October 1947	October 1948	% Change	Ten Months 1947	Ten Months 1948	% Change
Fabricated Structural Steel, tons, A.I.S.C.	196,139	159,092	−18.9	1,567,176	1,636,804	+4.4
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$325,882	$304,183	−6.7	$2,488,294	$3,349,222	+34.6

COST OF LIVING INDEX . . . EMPLOYMENT

Base 1935-39 = 100	1941	October 1947	October 1948	% Change	Sept. 1948	% Change Sept. to Oct.
Consumers' Price Index, B L S	105.2	163.8	173.6	+6.0	174.5	−0.5
Rent (Housing) Index, B L S	106.2	114.9	118.7	+3.3	118.5	+0.2

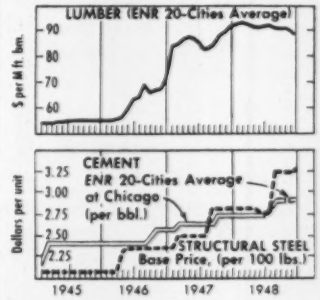
	September 1947	September 1948	% Change	August 1948	% Change Aug. to Sept.
Contract Constr. Employ. (est.), thous., B L S	2,107	2,240*	+6.3	2,253*	−0.6

* *Revised.*

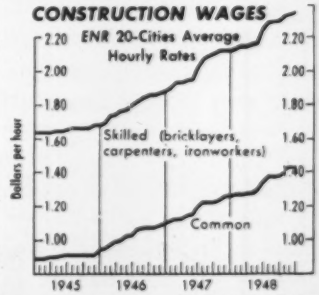
ENR INDEX NUMBERS

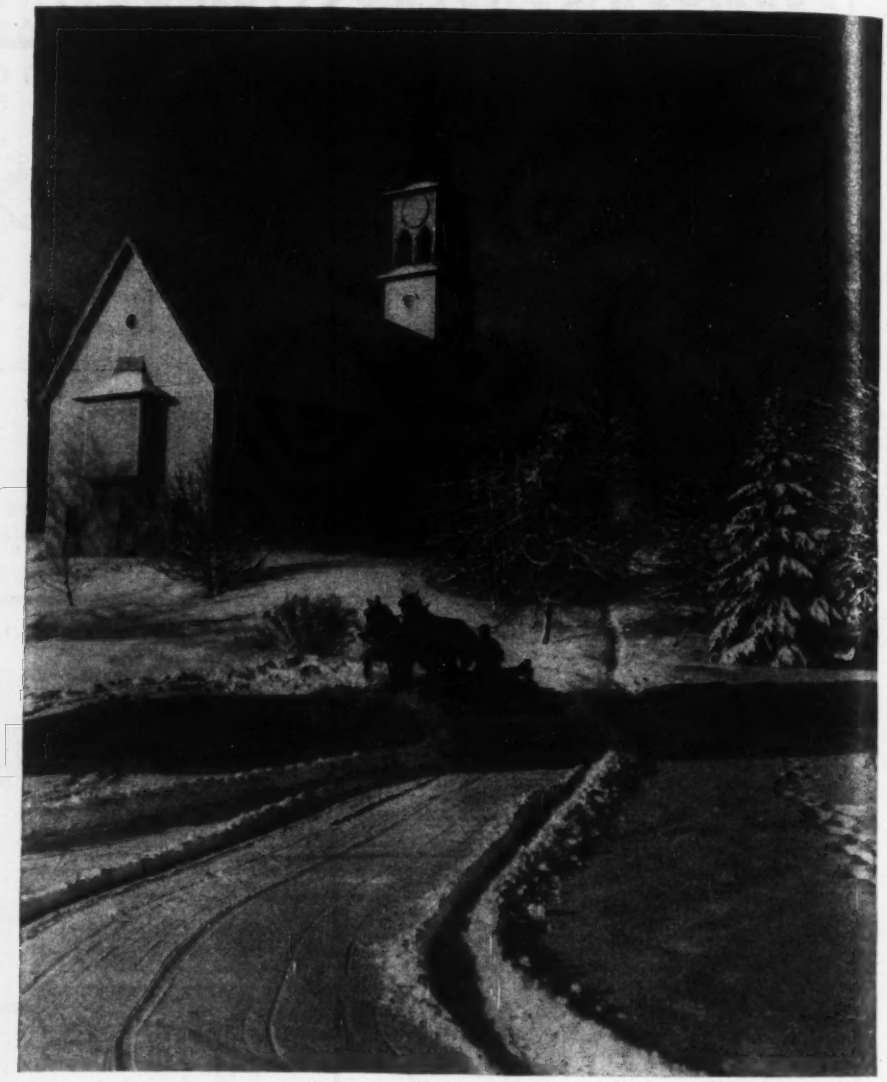
Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Dec., 1948	477.66	229.61	355.55	192.20		
Nov., 1948	478.25	229.89	355.86	192.37	203	89
Oct., 1948	480.21	230.84	357.07	193.02	291	128
Sept., 1948	478.40	229.97	356.70	192.82	240	105
Aug., 1948	477.11	229.35	355.45	192.15	255	112
July, 1948	464.83	223.44	342.42	185.10	265	116
June, 1948	455.80	219.10	339.26	183.39	282	124
May, 1948	444.86	213.84	333.93	180.51	259	114
Apr., 1948	443.64	213.26	334.56	180.85	302	132
Mar., 1948	443.60	213.24	334.22	180.67	247	108
Feb., 1948	442.67	212.79	335.49	181.36	231	101
Jan., 1948	441.65	212.30	333.58	180.32	173	76
Dec., 1947	441.13	212.05	333.06	180.04	246	108
1948 (Av.)	460.72	221.47	344.51	186.23	...	...
1947 (Av.)	413.16	198.61	312.96	169.18	228	100
1946 (Av.)	346.04	166.34	262.35	141.82	248	109
1945 (Av.)	307.75	147.93	239.14	129.27	123	54

MATERIAL PRICES



CONSTRUCTION WAGES





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To you, our customers and friends, we extend our good wishes this Christmas time. We shall appreciate your continued patience and understanding during the coming year. And, together, may we make our small contribution toward the pathway of peace.

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THE CONSTRUCTION WEEK

BREAK IT UP—President Truman has cracked down on the Army Engineers and the Reclamation Bureau, told them to stop fighting over who is going to build which dam and what kind of a project it should be. The idea is to get more money out of Congress for development of both agencies. The administration feels that inter-agency bickering, which confuses otherwise friendly congressmen, can block construction of blueprinted western river developments.

WATER FOR ONTARIO—The Ontario Hydro-Electric Commission has been dickering with the U. S. State Department for permission to divert more water through the Welland Canal for power development in its DeCew Falls plant during the winter months when no water is needed to operate the canal locks because no shipping is going through. Flow through the Welland Canal is included in the international agreement regarding diversions from the Niagara River.

MVA AGAIN?—Another Missouri Valley Authority bill will be introduced in the next session of Congress, but observers think it won't get beyond committee hearings. Most advocates can see there is too much local opposition in the West but figure that the introduction of the bill is part of an "educational" campaign to wear down this prejudice.

BANQUET BENEFITS—Dinners sometimes encourage more than good fellowship. A recent Washington banquet put three engineers side by side—from the Atomic Energy Commission, the Department of the Army and the Reclamation Bureau—and a Navy engineer across the table. The Army Engineer brought up an old dream—co-ordination and standardization of housing plans for government agencies as a step toward better buildings at lower cost. His companions had been nursing similar hopes. Now engineering representatives of the four agencies are quietly going about the job of arranging a meeting to discuss the proposal.

MORE ON BASING POINTS—Another straw to indicate the trend in government action on basing point price systems is contained in a joint address at Denver by Senator Homer E. Capehart, chairman of a special Senate subcommittee and his immediate successor, Senator Edwin C. Johnson. "Nothing the committee will do will weaken the Sherman anti-trust act or the government's power to prosecute price fixing conspirators," Capehart said. "But Congress and not the Federal Trade Commission must decide what pricing policies are for the best interests of the nation. The only pricing factor that may be used with assurance of legality in an industry where freight is a substantial part of the delivered cost is a uniform f.o.b. mill price."

NOT ENOUGH RAIN—U. S. Air Force plans for producing rain by "seeding" clouds with dry ice have been abandoned as too costly in the light of rain produced. A discouraging note for towns and cities that saw in the dry-ice seeding plan a way to augment their water supply, the abandonment of the project leaves it to nature to decide when and where "the rain raineth on the just and also on the unjust."

EXPORTS ARE DOWN—Exports to Europe and most other major geographic areas have been running below year-ago levels. Commerce Department's Office of International Trade is now estimating that total U. S. merchandise exports in 1948 will be about 15 percent less than 1947, when they came to $15.3 billion. (Allowing for price rises, the decline may run closer to 20 percent.) This compares with mid-year estimates of a 10 percent drop in value.

One reason for the greater-than-expected decline is that the full effect of ECA spending has yet to be translated into shipments.

PRESSURE OFF—Consulting engineers specializing in municipal water and sewage works projects are finding that the pressure for construction of such facilities is beginning to ease off. This does not indicate that backlog demands have caught up with required needs. It simply means that some communities are finding themselves unable to finance new projects at today's high prices. In the meantime, deferred maintenance and absolutely essential improvements continue to provide an impressive volume of work.

WHAT AUTHORITIES?—California citizens are taken aback by Reclamation Commissioner Straus who in recent West Coast conferences persisted in referring to the Central Valley Authority and CVA. Local boosters, who say that there is no law establishing any such authority, see in Straus' statements an effort to soften up local citizens for an attempt to establish a valley authority in California as well as in the Columbia and Missouri river basins.

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27-DRAWER SAFETY CABINET

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MODEL 1201 (illustrated)—Cabinet size, 30" wide, 37½" high, 17½" deep. Inside drawer size, 9" wide, 3½" high, 16" deep. **Price, $79.00***

MODEL 1202—Same dimensions as Model 1201, but **without** doors. **Price, $59.00***

MODEL 1203—"Letter Size" 27-drawer cabinet **without** doors. Cabinet size, 30" wide, 37½" high, 13½" deep. Inside drawer size, 9" wide, 3½" high, 12" deep. **Price, $49.00***

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  1. CAP — Interlocking Cover.
  2. UNIT — Five drawers operating on rollers, each drawer equipped with paper depressor on front and protecting hood on back to prevent sheets from curling. Drawers will not pull out accidentally, but may be completely and easily removed when desired.
  3. BASE — Interlocking Base—6 inch flush.
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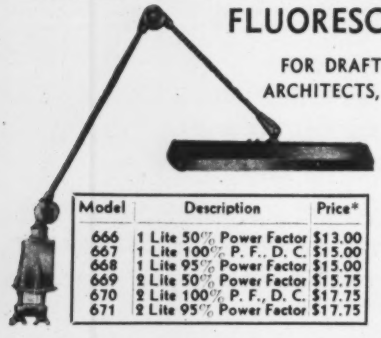
- Sizes noted in chart are for immediate delivery. If other sizes are required, please inquire.

PRICES *

Model	Inside Drawer Size	5-Drawer Unit 17" High	Base 6" High	Cap 1" High
1204	37" x 26" x 2"	$100.00	$12.50	$14.50
1205	43" x 32" x 2"	$113.50	$14.00	$16.50
1206	50" x 38" x 2"	$146.00	$18.50	$21.50

$5.00 additional charge per Unit for crating. Only one Base and Cap necessary, regardless of the number of Units to be stacked.



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Model	Description	Price*
666	1 Lite 50% Power Factor	$13.00
667	1 Lite 100% P. F., D. C.	$15.00
668	1 Lite 95% Power Factor	$15.00
669	2 Lite 50% Power Factor	$15.75
670	2 Lite 100% P. F., D. C.	$17.75
671	2 Lite 95% Power Factor	$17.75

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New Prospects For Tunneling?

BEHIND THE SCENES in the coal industry there is a rustle of new plans and radical experiments relating to mechanical mining methods that may have repercussions in the construction industry for small bore tunnels through not-too-hard material. The present objective is faster production of coal, and the efforts are being concentrated on an idea that has intrigued inventors for years—continuous mining. It should be possible, it has been argued, to develop a machine that would cut its way into a seam, without the necessity for stops to drill and blast—hence the term "continuous". It is a long jump, of course, from a machine that will dig soft coal to one that will excavate a tunnel. For one thing, the material encountered in a tunnel is seldom uniform, and it is often hard—conditions that have caused previous attempts to adapt boring machines to tunnels to fail. Tunnel cross-sections, too, are usually of rounded shape (difficult to make with a machine), whereas rectangular drifts are the rule in coal mines. The frequent requirements of shoring and lining in tunnels also contribute complications that are not present in equal degree in coal mining. Nevertheless, the fact that efforts to develop continuous mining machinery for digging coal are meeting with success gives the construction man a valuable precedent to work on. For materials varying in hardness from clay up to soft limestone, continuous machine excavation of small bore tunnels is still a possibility.

More Highly Trained Engineers

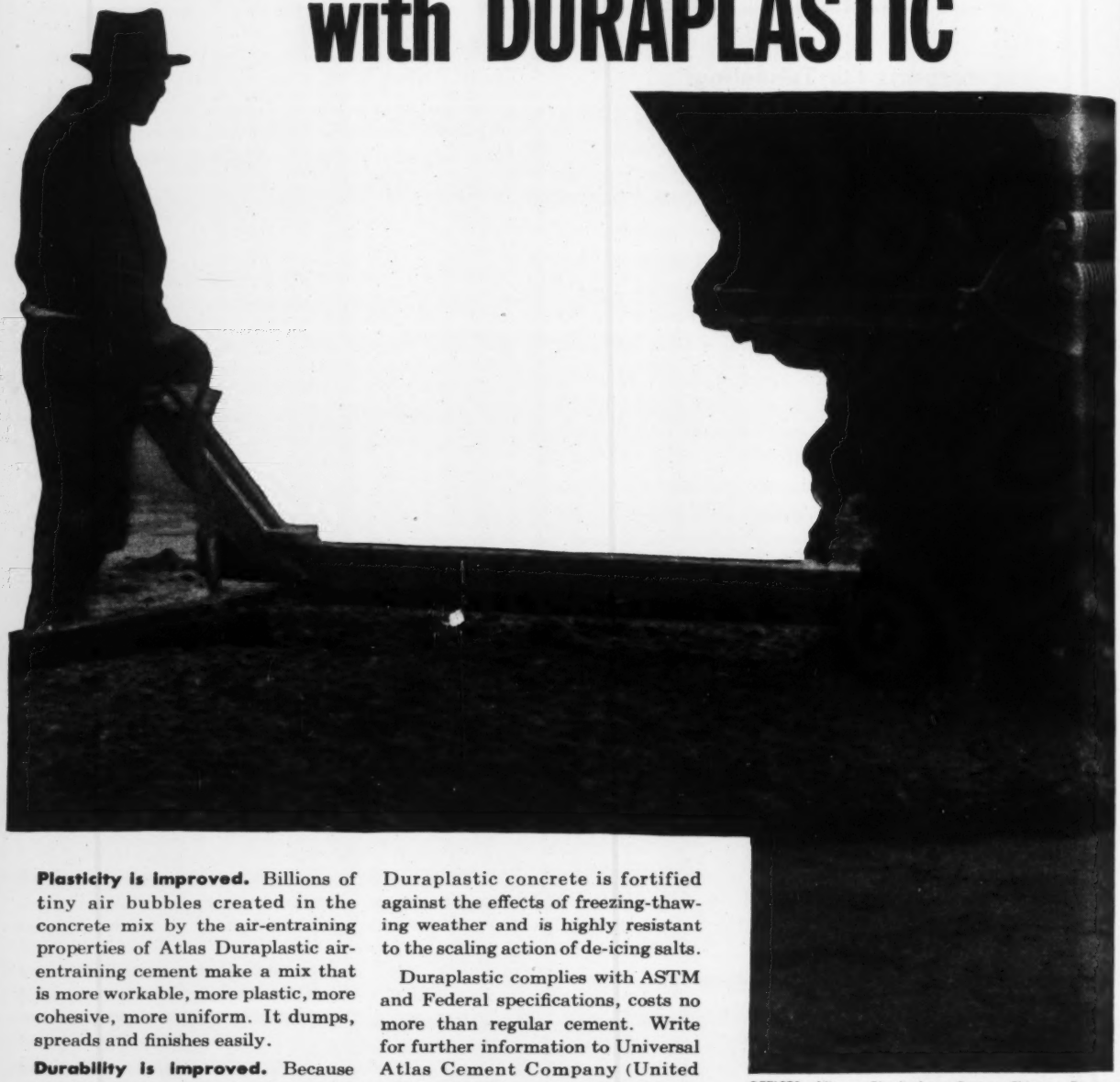
DEAN HAMMOND of Penn State College recently told the Engineers Council for Professional Development that only about five percent of the thousands of students now in our engineering schools are taking courses running more than four years. This is not adequate to meet the growing need for engineers of higher training, nor can any large increase in the number of graduate students be expected. When the educational benefits now available to war veterans end, it will be even more difficult than now for young men to devote the necessary time and money to postgraduate study. The solution obviously rests with men who will continue their training after they go to work by part-time study. Yet here is the area in which continued study is most difficult, due to family responsibilities or other demands on the time of young engineers who have the capacity for advanced work. A few companies like General Electric, Westinghouse and Allis-Chalmers have taken steps to facilitate part-time study by their employees as a means for insuring a continuing supply of highly trained men, yet much more must be done if the over-all national requirements are to be met. There must be more part-time training facilities, and more men must be encouraged to use them. Success depends very greatly on the extent to which employers, both large and small, give encouragement through promotion and better pay for the men who make the sacrifice required to get the added training.

America is Thirsty

SAMUEL TAYLOR COLERIDGE'S Ancient Mariner who, through parched lips, despaired "Water, water everywhere and not a drop to drink" should be living in America today. He would be stunned with wonder to learn how much water is consumed per person per day and how steadily the consumption rate is increasing. The record at Detroit illustrates the general trend that other cities in the United States have noted. In 1938, 1.96 million persons consumed an average of 125 gpd. but in 1948, 2.45 million residents are each drawing about 146 gpd. This represents an increase—which has not reached its peak—of nearly 17 percent.

What are the causes of this trend? Some experts believe that air-conditioning demands as well as expansion and modernization of industrial processes are major factors driving consumption up. Detroit's engineers are of the opinion that a great part of the increase is due to expanded facilities for use of water in the home. New York's experts, on the other hand, attribute rising water consumption to increased domestic waste. There may be a variety of reasons for changes in per capita water consumption. But whatever the causes, alert municipal engineers will want to re-examine their water supply, distribution and treatment systems in the light of the trend in Detroit. Such investigations, followed with decisive action for expanding the capacity of systems that now promise insufficient water supply under unprecedented demands, are obligations of prudent municipal management.

A more workable mix . . . with DURAPLASTIC



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ENGINEERING NEWS-RECORD

DECEMBER 9, 1948 VOL. 141 NO. 24

Administration housing bills readied for new Congress

Truman-Foley conference formulates two-part program—TEW bill features will all be pushed along with some form of liberalized mortgage insurance

Administration bills on housing probably will go to Congress in two parts, according to an announcement by Administrator Raymond M. Foley of the Housing and Home Finance Agency after a recent conference with President Truman. Enactment of the legislation is not expected to affect substantially the total number of housing starts for next year, estimated at 875,000 by the Bureau of Labor Statistics, as noted elsewhere in these pages.

Part one, already well documented by past hearings, will consist of those portions of the Taft-Ellender-Wagner bill that the special session failed to pass this summer—federal subsidies for low-rent housing, federal loans and grants for slum clearance, financial assistance by the Secretary of Agriculture for farm dwellings, and an expanded program of federal research under HHFA.

This part of the legislation will go early to Congress. It was passed by the Senate last spring, but the rules committee in the House blocked the last chance for a vote on it by that body. House hearings this time ought not to delay it long. A housing bill embracing the four provisions should pass Congress within two or three months after the session convenes.

Effects not immediate

Effects of this legislation will appear later; they will be evident chiefly in a shift to more multifamily urban projects—first for low-income groups and later, it is hoped, for renters in the moderate income class. If steel, cement and other building materials and equipment remain in tight supply for two years more, the shift may affect the volume of other construction, including residential.

Materials allocations are not part of the administration's present plans for pushing low-price housing. Any controls for this purpose would be part of a broader program. The Council of Economic Advisers undoubtedly is studying the subject as part of the President's assignment to delve into the whole problem of inflation. If the administration should ask for controls, the best guess today is that they would be on a standby basis.

Send part of legislation

More immediate in its effects on housing might be the second piece of legislation. This part would go through later. Unless Congress wants to lower even more the bars against inflation, it would be difficult to go much farther than present housing laws in liberalizing mortgage insurance. One possibility would be to widen the authority of the Federal National Mortgage Association—the government's secondary mortgage market—to buy GI and FHA-insured mortgages. The authority is now limited to 50 percent of a lender's portfolio.

These views are purely speculative. The legislation—part two, that is—has not yet even been drafted. It will have to go through the mill of administration approval before it is submitted to Congress. Guesses as to its eventual form are premature, as also are the possible action Congress may take.

Administration's influence

Tied in with the legislative proposals—and also apart from them—the full weight of the administration's effort for 1949 will be directed toward production of more low-priced housing and more rental housing. Home builders and materials suppliers are already acutely aware of the need for more low-cost houses. They seek the cooperation of the lending institutions, and they are working closely with HHFA in the drive toward reaching that objective.

Here are the estimates on what the first legislation may include, as indicated by the bill that had administration backing:

Public Housing—TEW would have authorized federal rent subsidies to encourage construction by local authorities of rental projects for low-income families. It aimed for the building of not more than 500,000 living units in five years. Subsidy authorizations were to start at $32,000,000 the first year and increase by like amount per year to $160 million for the fifth year and each year thereafter. The finan-

(*Continued on p.* 72)

Agencies plan low-cost housing drive

Officials of six federal agencies met Dec. 1 to plan a drive that will help activate the administration program for getting a much larger volume of lower cost housing produced in 1949.

Raymond M. Foley, HHFA administrator, presented initial plans for a nation-wide series of meetings early in 1949. These meetings will be held in many places in cooperation with all elements of the housing industry to stimulate action programs for an expanded volume of sale and rental housing in the lower price brackets. The plans call for a much more extensive effort than the recent series of regional and local meetings to translate existing federal aids and legislation into lower cost sale and rental units.

At the meeting were representatives from all member-agencies of the National Housing Council—the Housing and Home Finance Agency, the Department of Agriculture, the Department of Commerce, the Veterans Administration, and the Reconstruction Finance Corp. The HHFA group included the Federal Housing Administration, the Home Loan Bank Board and the Public Housing Administration. In addition to the member agencies, representatives of the Bureau of Labor Statistics and the Bureau of Apprentice Training, Department of Labor, took part.

All the participating agencies are now at work on methods of furnishing information and assistance that will help private industry concentrate on the lower-cost and rental fields. The agencies are putting all facilities at their disposal into the effort.

NEWS BRIEFS

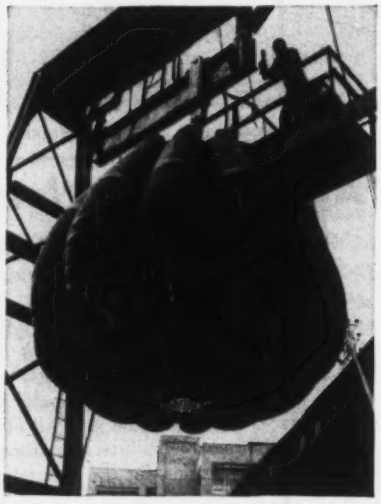
Airports—Construction has started on a new $1,000,000 airport near LIHUE on the Hawaiian island of KAUAI. The American Contracting Co. will build a 3,750 ft. runway with territorial and CAA funds. . . . A $4,000,000 steel frame hangar is planned for Boeing Field at SEATTLE, WASH., to house latest model bombers during flight test operations. . . . Connecticut's Aeronautics Administration plans a runway extension and addition of a $1,000,000 terminal building at Bradley Field, WINDSOR LOCKS. The former fighter base has been turned over to the state for development into an international airport. . . . CAA has announced that bids will be received Dec. 15 at ANCHORAGE, ALASKA, for contracts to build an $8,000,000 airport at that city. Proposals will be invited next spring for a $5,000,000 installation at FAIRBANKS. Thomas B. Bourne & Associates is preparing plans for both projects.

Public Construction—The $5,000,000 power plant now under construction at PORTSMOUTH, N. H., is expected by the Public Service Commission of that state to be completed and in operation by 1950. . . . Beers Construction Co., of ATLANTA, GA., is to build a $1,574,000 hospital and nurses' training school at the Florida A. and M. College for Negroes in TALLAHASSEE. . . . U. S. Engineers indicate that the Great Lakes Dredge & Dock Company bid of $715,500 on the first phase of the BUFFALO, N. Y., $13,000,000 harbor improvement will be accepted, and construction will start as soon as possible. . . . A pier to cost $6,000,000 will be built by the BOSTON Port Authority, for lease to the Boston & Maine Railroad.

Highways—MARYLAND State Roads Commission plans to spend $200 million on road construction improvement in the next five years. . . . Plans for the first section of the new interregional highway through DAYTON, OHIO, have been presented to city officials. The $7,000,000 job is expected to be under contract by June, 1949. . . . PRA has awarded a $2,859,000 contract to Morrison-Knudsen Co. of Boise, Idaho, and S. Birch & Sons Construction Co., of Great Falls, Mont., for paving 53 miles of the Richardson highway in ALASKA. . . . Governor Jester has announced a goal of 14,800 miles of rural roads to be paved by 1951 in TEXAS. . . . Completion of the Trenton Freeway is included in a $7,750,000 construction program proposed by NEW JERSEY State Highway Commissioner Miller for 1949-50. . . . An IOWA legislative highway study committee has recommended that the state embark on a 20-year, $1.8 billion program of highway construction and improvement. . . . CONNECTICUT'S state highway construction program for 1949 will total nearly $18,500,000, and another $3,000,000 will be added to the total in purchase of rights-of-way for projects due for later construction. . . . In NEBRASKA a 20-year plan and also alternate 10-year and 15-year programs been suggested in a report presented to the governor by the Highway Advisory Committee.

Bridges—A $3,000,000 bridge over the Little Cuyahoga River is now being planned in the first freeway for AKRON, OHIO. . . . Voters of GREAT FALLS, MONT., have approved a bond issue to pay the city's share of a $1,000,000 bridge project. The structure will carry a highway to route traffic around the business district. . . . Preliminary surveys are being made for a proposed bridge over the Ohio River at LAWRENCEBURG, IND. The bridge would connect U. S. Highway 50 in Indiana with Kentucky Highway 20, and provide a direct route from Cincinnati to St. Louis.

Dams—Twenty-six steel gates, each weighing 35 tons, will be built by the Koppers Co., Inc., for the new Conemaugh River Dam in western PENNSYLVANIA. Cost of the gates will be $1,230,000, and the contract provides for delivery in 360 days. . . . Low bid on a major earthwork project at the Fort Randall Dam on the Missouri River in SOUTH DAKOTA was submitted by Western Contracting Corporation of Sioux City, Iowa. The concern bid $4,198,000—nearly $230,000 above the Corps of Engineers' estimate. . . . Construction of the $6,000,000 Panther Mountain reservoir on the Moose River in HERKIMER COUNTY, N. Y., has been ordered by the Black River Regulating Board.



TESTING NYLON SALVAGE PONTOON — Using impregnated nylon cloth spread with synthetic rubber, Goodyear has devised this 25-ton capacity float for the Navy. In this test the pontoon is filled with 25 tons of salt water. So light that one diver can handle it, it can be attached to any sunken object and inflated from surface pumps.

Congress to be presented two part housing program

(*Continued from p. 71*)

cial aid—to cover the annual difference between income and outgo on each project—was limited to 40 years. This program may be modified in detail by the incoming Congress, but no pressure is apparant at present to enlarge it in scope.

Slum Clearance—For land assembly in blighted areas by cities and towns to assist (1) slum clearance and (2) sale of the plots to redevelopers at prices that would permit building development on a business basis, TEW authorized a five-year program of loans at $200 million a year and grants—to help cover the write-downs in land prices—at $100 million a year. There is no talk yet of increasing this program, involving a maximum grant commitment of $500 million.

Expanded Research — Housing research by HHFA certainly will be given a broader charter. The Housing Act of 1948 limits it to building codes and standardized methods of construction. The new legislation can be expected to implement the TEW idea of making HHFA the national housing research agency—a central clearing house to coordinate and promote all phases of research, economic and statistical, as well as technical. Results of such action would take years to develop, but broad-scale research authority could be one of the most potent factors in the future of housing. Proponents want it to find and fill in the research gaps; opponents fear its potential power and influence.

Aid to Farmers—TEW would have authorized the Secretary of Agriculture within a four-year period to make housing loans to farmers totaling $250 million, the loans to run for 33 years at 4 percent interest. For housing on low-income farms, grants totaling $12,500,000 in four years were provided.

BLS sees $18 billion '49 construction

Dollar value of new construction to be put in place during 1949 is expected to reach a new record of $18.75 billion, but physical volume probably will not exceed 1948 performance, the Bureau of Labor Statistics, U. S. Department of Labor, reported recently.

Forecasts of expenditures for new construction in the coming year, prepared jointly by the departments of Commerce and Labor, exceed the anticipated dollar volume for 1948 by about 5 percent, or slightly less than $1 billion. Most of the increase is expected to be in outlays for new public construction, with private expenditures remaining almost unchanged.

These predictions are in close accord with an earlier report by the McGraw-Hill Economics Staff (*ENR* Nov. 4, p. 4).

On the basis of the expected dollar volume, BLS estimates that about 2,300,000 workers will be employed by construction contractors at the 1949 peak next September. This is about the same number that were engaged on contract construction in August, the peak month this year.

The present outlook for the number of new permanent nonfarm dwelling units to be started next year is about 875,000. Upwards of 30,000 of these are expected to be financed with public funds, largely in state and municipal projects and in military installations. The 1948 volume is now expected to be about 925,000 units, of which not more than 15,000 will be publicly financed. BLS estimates that next year a greater proportion of dwelling units will be built in multi-family structures—roughly 15 percent compared with 10 percent this year.

Costs and availability are factors

All estimates are predicated on continued high levels of employment. The estimators assumed that federal expenditures for military preparedness will not exceed the amount already in sight, and that average construction costs in 1949 will be about 5 percent above the average anticipated for 1948. Furthermore, the forecast for 1949 assumes that building materials production will be adequate for the expected construction volume, even though steel products and cement may continue in tight supply.

BLS points out that maintenance of a high volume of home building in the coming year depends largely upon the facility with which builders adjust their operations to a larger proportion of lower priced homes than have been built this year. In estimating the probable number of new houses to be started in 1949, bureau officials explain that they could not take into account some influences which may or may not develop during the year, such as new legislation on housing or on mortgage financing—both discussed on p. 71 of this issue.

New York names Devendorf to head sanitation bureau

The New York State Department of Health has announced the appointment of Earl Devendorf as director of the department's Bureau of Environmental Sanitation, succeeding Charles A. Holmquist.

Mr. Holmquist, oldest member in point of service on the professional staff of the State Health Department, retired Nov. 1 after 40 years of service with the organization. A 1902 graduate of the University of Rochester, Mr. Holmquist's long service has included membership on many interstate and national groups dealing with sanitation and he has lately been a member of the Subcommittee on Minimum Requirements for Plumbing of the American Standards Association.

Mr. Devendorf, associated with the department for over 30 years, has been assistant director of the bureau since 1927. He is a graduate of Union College (1912) and has served New York State as state coordinator in collaboration with the State Council of Defense. He is holder of the George Warren Fuller Memorial in recognition of outstanding service to the waterworks profession.

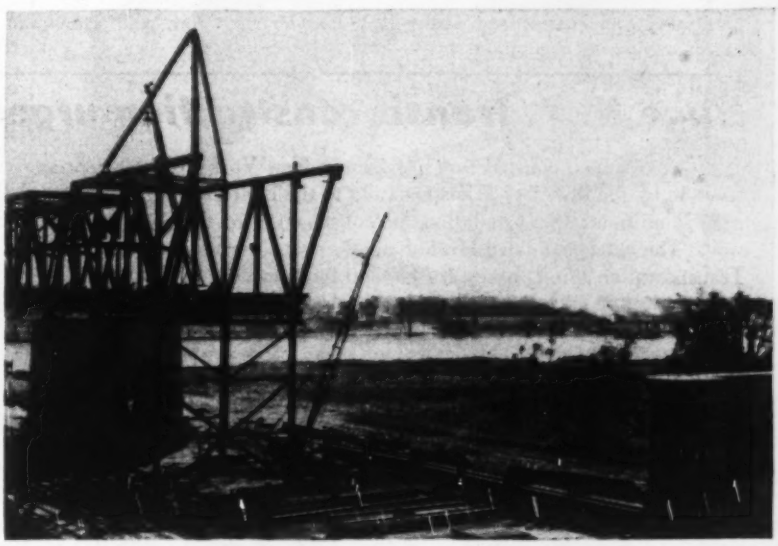
Highway research group formed in Virginia

The Virginia Department of Highways will move its research section from Richmond to Charlottesville where the offices and laboratories will associate with the department of engineering at the University of Virginia to form the Virginia Council of Highway Investigation and Research.

The new council will be administered by a board composed of C. S. Mullen, chief engineer for the department of highways, as chairman; Edward W. Saunders, university dean of Engineering; and T. E. Shelburne, director of research for the department of highways.

Heads of the civil engineering departments of Virginia Military Institute and Virginia Polytechnic Institute will be members of a highway research advisory committee.

Objectives of the project are to carry out research programs for economic design, construction, and maintenance of highways; to train men in fundamentals of highway engineering and related subjects; and to cooperate with research divisions of other highway departments, universities, and public and private agencies.



BRIDGING THE MISSISSIPPI progresses at Memphis, Tenn., where Harris Structural Steel Co., Inc., has superstructure between piers VI and VII well under way. Erection goes on over one temporary bent while another is being dismantled. Merritt-Chapman & Scott Corp. are substructure contractors. (A Corps of Engineers Photo).

USPHS forms water pollution division

The U. S. Public Health Service has reorganized its sanitary engineering branch to carry out more effectively the functions assigned to it by the Water Pollution Control Act of 1948. In place of the former sanitary engineering division the organization now has two divisions, one for water pollution control and the other for sanitation.

Surgeon General Leonard A. Scheele announced the reorganization early this week. The change expands the former water pollution control section into a full-fledged division. Its chief purpose, as directed by the law, is to give financial and technical assistance to the states in formulating and carrying out their stream pollution control programs.

To help it in discharging this task, the division will have under its wing 14 river-basin offices that will be competently staffed to serve the states, interstate agencies, municipalities and industries in their drainage areas (*ENR*, May 13, Vol. p. 691). Two of the offices are already operating, and the division hopes to open three to five more by the first of the year or soon after.

The two divisions and the environmental health center (the USPHS laboratories in Cincinnati) report to Assistant Surgeon General Mark D. Hollis, chief sanitary engineering officer of the Public Health Service and former chief of the sanitary engineering division. Helping him will be M. Allen Pond, senior sanitary engineer, newly appointed assistant chief of engineering activities. To head the new divisions, Dr. Scheele appointed two sanitary engineers: Carl E. Schwob as chief of water pollution control and Callis H. Atkins as chief of sanitation.

All functions of the former division of sanitary engineering except water pollution control and research in environmental sanitation are taken over by the new division of sanitation.

Under the water pollution control law, signed by the President June 30, funds may be appropriated by future Congresses for several purposes, including federal grants to aid the preparation of plans and loans to assist either the planning or construction of treatment works. These funds are to be administered by the Federal Works Agency through its bureau of community facilities. A project must be approved by the state water pollution control agency and by the surgeon general of USPHS before it can receive a grant or loan. Procedures for obtaining financial assistance are now being drafted by the Public Health Service and the Bureau of Community Facilities.

River basin offices of USPHS are already in operation at Portland, Ore., for the Pacific Northwest, with Robert Harris as engineer in charge, and at Kansas City, Mo., for the Missouri River Basin, with Glen Hopkins as basin engineer. Other offices will be located at Boston, New York, Washington, D. C., Atlanta, Cincinnati, Chicago, St. Louis, Little Rock, Dallas, Boulder City, Nev., and San Francisco (two offices).

Huge N. Y. transit construction urged

A 6-year transit construction program in New York City was recommended Nov. 30 by the Board of Transportation to the Board of Estimate. It included a $353 million recommendation for construction of the Second Avenue subway. The total estimated cost of all the transit works which the Board of Transportation thinks necessary is $800 million.

The Board of Transportation believes that efforts should be made by the city to persuade the state Legislature to allow a $500 million exemption from the city debt limit for transit construction purposes.

It is said that the Second Avenue trunk line is the greatest present need of the city's rapid transit system and that other construction covered in the estimates more or less depend upon the building of that line on the east side of Manhattan. It would extend from Houston street to 125th street and under the Harlem River to the Interboro Pelham line at 138th Street, the Bronx. About $205 million will be required for this portion of the work which would take six years to complete.

Transit rehabilitation plans also include, among others, the following: A connection between Dyre Avenue and the IRT White Plains Road line at East 180th Street, the Bronx, $1,400,000; a connection between the Williamsburg Bridge-Manhattan Bridge-Nassau Street BMT line and the IND Houston Street line and the proposed Second Avenue trunk line between Canal and Houston streets, $36,500,000; construction of two additional tracks on the IND Sixth Avenue line from West 4th street to 34th street, $13,700,000.

Real estate interests are understood to oppose the plan of a large exemption from the debt limit for transit purposes. They don't want the city's borrowing or taxing powers to be increased. However, a committee appointed by State Comptroller Moore has reported that real estate in New York City is now bearing less than half the cost of government of the city, according to William Reid, chairman of the Board of Transportation.

Bids called on large dam near Williamsport, Pa.

Bids for a flood-control and recreation dam on Little Pine Creek, a tributary of the Susquehanna River north of Williamsport, Pa., have been called by the Pennsylvania Department of Forests and Water.

The dam is to be an earth fill, 115 ft. high and 1,200 ft. long. It is to create a detention reservoir of 8 billion gallon capacity. All but the bottom 20 ft. of storage will be discharged after each flood through a 15-ft. diam. conduit. The remaining pool will be available for recreational use except in flood seasons. The cost is estimated at over $2,000,000.

Engineers for the dam are Gannett, Fleming Corddry and Carpenter of Harrisburg, Pa.

Low bids are announced on Delaware River crossing

When bids were opened Nov. 30 by W. W. Mack, director of the Delaware Crossing Division, Delaware State Highway Department, Merritt-Chapman and Scott Corp. of New York was the low bidder for the approach piers and anchorage blocks for the new $40,000,000 Delaware River Memorial Bridge to be built near Wilmington, Del.

The bid was $1,291,240 on the approach river piers, and $1,830,000 on the anchorage blocks. Merritt-Chapman and Scott are present contractors on the foundations for the two main anchorages and the two main tower support piers now under construction.

Low bidder on the west approach land piers was Conduit & Foundation Corp. Philadelphia, Pa., at $609,520 and the low bidder on the east approach land piers was Lewis & Bowman, Norfolk, Va., at $709,650.

Frank V. duPont, chairman of the Delaware State Highway Department, said that when the contracts are let for which bids were opened yesterday, half of the total costs of construction of the bridge will be under contract.

Mosquito eradication test on Sardinia promises malaria-free tropical areas

Mechanized methods and refined scientific controls are being applied in a vast field experiment to destroy the entire malaria-carrying mosquito population of this Mediterranean island

A large-scale anopheline-mosquito eradication project, that has all the elements of modern warfare including planes and flame throwers, is being carried out on Sardinia, the second largest island in the Mediterranean.

The work is being executed by a special organization, ERLAAS (Ente Regionale Lotta Anti Anophelica Sardinia), under the direction of the International Health Division of the Rockefeller Foundation. ERLAAS was created and set up in the federal health department by Italian Government decree.

Supplies, transport and lira finances, which were originally furnished by UNRRA through the Italian Government, will be made available during the next two years from the Marshall Plan Italian Lira fund.

In addition to providing technical and administrative direction for the project, The Rockefeller Foundation is furnishing a dollar budget for purchases made outside of Italy.

Directing the work is John A. Logan, Harvard-educated sanitary engineer, who is engineering representative for the foundation in Europe. Previous to this assignment, Dr. Logan supervised the sanitation program in the Amazon Valley for the Institute of Inter-American Affairs. Among his other experiences were: chief engineer for Russell and Axon, consulting engineers of St. Louis, Mo., and assistant professor of sanitary engineering, University of Missouri.

Eradication is directed primarily against the *A. labranchiae* mosquito, the only recognized carrier of malaria in Sardinia. This indigenous species is found at all altitudes and in every section of the island.

Using DDT as the exterminating agent, the campaign embraces both anti-adult and anti-larval programs. Planes, flame throwers, fog applicators and other up-to-date equipment have been widely used. Considerable reliance is placed, however, on manual procedures using small "flit-gun" sprayers for larviciding and the shoulder pump for residual house spraying.

To insure that lethal doses of the larvicide (DDT in oil) reach the water surfaces, an extensive program of clearing vegetation has been necessary. In addition, large areas have been drained by either dug or blasted ditches.

Following the preliminary entomological survey, stockpiling and experimental phase, which began in 1946 and ended Oct. 15, 1947, the all-out extermination program was initiated. The execution phase was recently concluded. It will be followed in 1949-50 with intensive scouting for residual mosquitoes, mop-up operations and development of adequate quarantine and control measures.

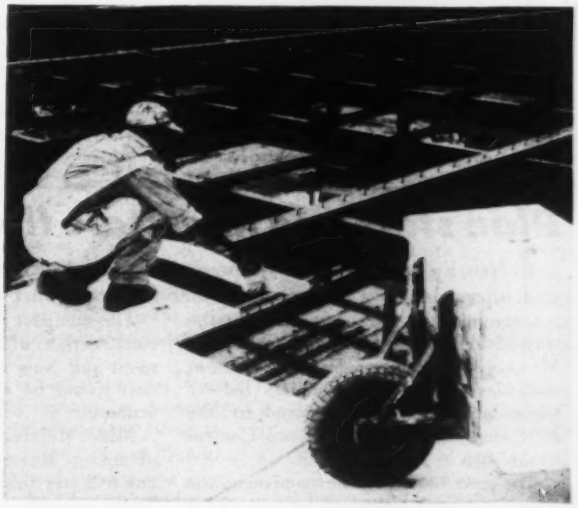
Other species destroyed

Mechanized eradication procedures not only have resulted in widespread destruction of *A. labranchiae* mosquitoes but also have caused a considerable reduction of other anopheline species. This development has led to the adoption of a secondary objective—general mosquito eradication.

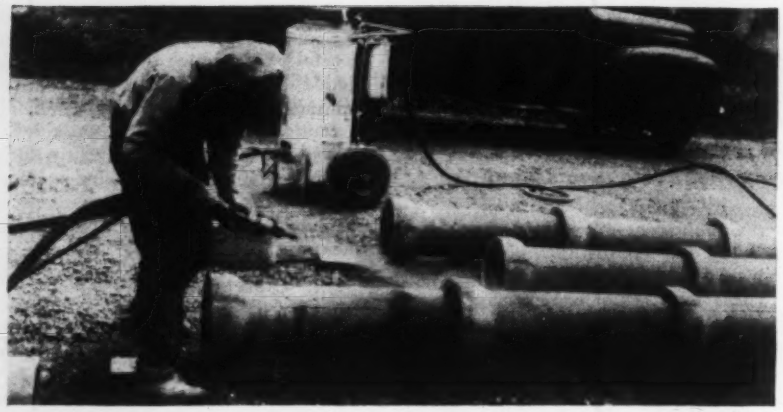
The attempt to eradicate an indigenous malaria-transmitting mosquito is a logical extension of The Rockefeller Foundation's successful work in exterminating the *A. gambiae* species in Brazil and Egypt. Modified to meet existing conditions, similar techniques to those perfected in the original campaigns are being applied in Sardinia.

Successful completion of this program will have widespread significance in pointing the way to casting off the malarial yoke that retards economic development of rich tropical areas. Public-health engineers and agricultural and mining experts in many parts of the world are watching this program with close interest.

WINDOWLESS WALLS in the nine-acre warehouse being built for L. Bamberger & Co. at Bloomfield, N. J., comprise a 10-ft. band of prefabricated aluminum wall panels above a poured concrete section. Other architecturally modern walls are of colored enameled steel panels. The building was designed by Abbott, Merkt & Co., and Wm. L. Blanchard Co. is the contractor.



MAN-HANDLED ROOFING—Tile which comes in a conveniently shaped, 23-lb. slab is used on the warehouse roof, framed of 12-in. purlins and specially designed 14-gauge steel sub-purlins. This lightweight slab, developed by American Structural Products Co., is designed for a load of 50 pounds per square foot and is easily transported and handled by common labor on the roof.



CONCRETE SEWER PIPE JOINTS are made with gunite on small diameter pipe in a speedy Portland, Ore., operation.

THREE-LENGTH ASSEMBLIES are lowered into the trench with a pair of tongs suspended from a backhoe.

Pre-joining with gunite speeds sewer line work

Construction of small diameter sewer lines in Junction City, Ore., was facilitated by pre-joining three lengths of concrete pipe. A portable gunite machine of the Nicholson type was used for the joints made before placing the pipe in the trench. After the mortar had set. the pre-assembled lengths were lowered in the trench by a pair of tongs attached to the back-hoe used for excavation.

Joints in the trench were made by hand caulking a dry cement-mortar mixture. Using these methods, one crew laid as much as 600 ft. of pipe in an 8-hr. shift.

The work was designed by John W. Cunningham and Associates, consulting engineers, Portland. Ore., represented on the job by Carl E. Green, one of the associates. The general contractor on the $134,000 contract for sewer line work was Thorburn and Logozo, Seattle, Wash.

Plan state and interstate flood control

In New England and in Iowa steps are being taken to organize for statewide and interstate flood control and water resources work.

Only minor differences stand in the way of a flood control compact among Massachusetts, Connecticut, Vermont and New Hampshire. Officials believe the compact will be approved by the New England Interstate Flood Control Committee.

The next move will be to present the compact to the 1949 legislatures of the four states. The final step would be Congressional action for approval.

"Committee members from the four states are all agreed on major points of the compact," said Director Richard Martin of the Connecticut State Water Commission.

The compact would pave the way for construction of 10 reservoirs in Vermont and New Hampshire. Most of the cost would be met by the federal government.

Minor differences involve the amount of money Massachusetts and Connecticut will pay the two northern states for land taxes to be lost by the construction of the dams. Vermont and New Hampshire have complained that, while they would be paid for the price of the land used, it would become federal property and therefore be tax exempt. They claim that the dams would remove valuable land from tax lists, and result in heavier taxes on other land owners. They also point out that Massachusetts and Connecticut would be the chief beneficiaries from the flood control.

Iowa flood control report

An Iowa interim flood control committee has filed a report declaring that immediate establishment of a statewide water control and resources council with dominant authority is imperative.

The 12-member committee, created by the 1947 legislature, made an eight months study of Iowa water resources, flood control, erosion, drainage and kindred topics and filed a 69-page report with Gov. Robert D. Blue for transmission to the 1949 legislature Jan. 10.

In addition to the water control and resources council, which the committee terms its major recommendation, the group also proposes legislation to put more teeth in the state's stream pollution laws, set up benefitted flood control and soil conservation districts, aid the financing of municipal and district sewage treatment plants and extend and modernize present drainage laws.

Included in the recommendations are two proposed bills to aid school districts which may be affected by the taking over of large land areas through the eventual construction of four federal dams now planned in Iowa.

Seek government aid for Mo. Valley development

Missouri River development continues to be a very live topic and early Congressional action is to be sought to implement the plans that are being made by its proponents.

Senator Gurney of South Dakota is going to ask the 81st Congress for a deficiency appropriation of at least $30,000,000 for that development, while Senator Murray of Montana is going to resubmit his bill to set up a Missouri Valley Authority.

The large appropriation will be asked with a view of bringing work on the river up to the schedule planned by the Missouri Basin Inter-Agency Committee. This has to do with the construction of the dam at Garrison, N. D. and those at Oahe, Fort Randall, and Gavins Point, S. D. Senator Gurney says that Fort Randall Dam should be furnishing electricity by 1953, Garrison Dam by 1954, and Oahe by 1956.

As to a MVA, Senator Murray says the people of that area are more than ever convinced that an authority will be the best solution of their problems. He said that his measure will provide the fullest safeguards for the states concerned so that rights and interests of the entire valley will be protected.

U. S. charges restraint of culvert competition

Culvert makers and association charged with allocating trade territories—New York Trap rock monopoly also charged

A civil antitrust complaint charging the Republic Steel Corp., 19 other fabricators of culvert pipe, and the Toncan Culvert Manufacturers' Association with restraining competition in the manufacture and sale of corrugated sheet metal and culvert pipe has been filed in Cleveland federal court by the U. S. Department of Justice.

The complaint charges that Republic and the 19 other fabricators have allocated territories for making and selling the pipe. Republic, it is charged, reserved the exclusive right to make and sell this pipe in Ohio, West Virginia, Pennsylvania, New Jersey, Delaware, Maryland, the District of Columbia, and in all foreign countries.

Each of the 19 other fabricators, the complaint states, has received the exclusive right to make and sell the pipe in carefully defined geographical areas throughout the United States. Further, it is charged, each of the 19 fabricators has agreed to buy all its requirements of sheet metal for culvert pipe from Republic.

The complaint alleges that the Toncan Culvert Manufacturers' Association aided enforcement of the restrictions on the manufacture and sale of metal culvert pipe and participated in establishing quotas of sheet metal used by Republic in allocating this product.

Crushed stone case

In another part of its campaign against alleged monopolistic business practices, the justice department filed a civil suit charging the New York Trap Rock Corp. and three of its officers with violations of the Sherman Act.

Individuals named as defendants in the action, all of them residents of New York, are Wilson P. Foss, Jr., chairman of the board of directors; Wilson P. Foss, III, president and director; and J. C. Dooley, vice-president and director.

The complaint alleges that the New York Trap Rock Corp. by a series of mergers, acquisitions and illegal agreements eliminated competition between itself and competitive producers of crushed stone and built a monoply in the crushed stone industry in the New York metropolitan area.

The government's complaint asks the court to enjoin the defendants from continuing their allegedly illegal activities and requests that they be ordered to cancel their allegedly unlawful contracts.

BIG INDUSTRIAL ADDITION to the Houston, Tex., area is this $14,500,000 electro-chemical plant opened last month by the Diamond Alkali Co. Under construction since 1946 by Brown & Root, Inc., of Houston, the new works will produce 220 tons of liquid chlorine and 240 tons of caustic soda daily.

Commenting on the action, the attorney general said, "The filing of this complaint represents another step pursuant to the department's announced program of freeing the construction and housing industries from monopolistic practices."

Herbert A. Bergson, assistant attorney general in charge of the antitrust division, said "This suit charges that the New York Trap Rock Corp. has acquired control of the production of approximately 90 percent of all crushed stone used in the New York metropolitan area, with annual sales amounting to more than $4,500,000."

Southeastern floods fill power-system reservoirs

Unusually heavy rainfall that approached nine inches within 24 hours at some points in southeastern states had a beneficial effect on power water supplies in the area, despite considerable property damage due to floods.

The floods followed a month of extremely heavy rainfall, culminating in the extraordinary 24-hour precipitation of just short of nine inches in the area around Birmingham, Ala., and at other points.

Coming at a time when the huge Tennessee Valley system is normally drawing down its reservoirs, however, the floods removed the threat of "brown-outs" which TVA and local power companies reportedly had been considering as a means of conserving water supplies for hydro projects. The Southern Co., a subsidiary of the Commonwealth and Southern Corp., reported all its storage reservoirs filled to capacity, and said it expected good conditions to continue at its installations.

U. S.-Britain agree on standard screw thread

As a result of an agreement reached in Washington last week, all ordinary bolts, nuts and screws manufactured in Great Britain, Canada and the United States will have a common thread standard.

Eventually this will mean a complete interchangeability of vital parts in all types of machinery produced in the three countries.

The three-way agreement was reached after 30 years of negotiation. It eliminates a 5 percent variation in the angle of threads which has existed for more than 80 years. Minor modifications in the top and bottom of the thread of the bolt and nut will also be made.

The standard will eliminate large inventory requirements for such items as multiple-standard dies, gages, taps and tools for screw, bolt and nut production, as well as ending product duplicate inventories.

At the same time, Sir Edward Smith, chief engineer of the Imperial Chemical Industries, London, said he foresaw another step in unification in the adoption of the American drafting room practices so that two countries' drawings eventually may be unified.

Under the standardization agreement, the British will make the major departure from previous practice. The British system, originated in 1845, is based on a thread angle of 55 deg. with a thread form having rounded crests and roots. The American system, developed in 1864, has a thread angle of 60 deg. with a thread form having flat crests and roots. The present agreement calls for a 60 deg. angle and a rounded root for screw threads with the crest either rounded or flat.

Minimum requirements for GI homes announced

Minimum construction requirements —assuring veterans that the houses they purchase with the aid of GI loans are of sound construction—have been announced by Veterans Administrator Carl R. Gray, Jr.

The standards apply only to proposed construction for sale to veterans where VA is asked to give an appraisal of reasonable value before construction begins.

An individual veteran building a home for his own use may disregard the standards if he chooses, provided the house meets the requirements of the GI bill that it is "suitable for dwelling purposes" and that the cost does not exceed the "reasonable value" as determined by VA. However, VA inspection service during construction will not be provided unless the plans meet the minimums prescribed.

Administrator Gray also issued suggested guides for site planning and architectural design and arrangement of such homes. While not mandatory, these guides are strongly recommended by VA and will be taken into consideration when new properties are appraised for GI loan purposes.

The construction requirements, effective Dec. 15, deal with quality of materials, construction techniques, workmanship, installation of necessary home equipment, and related structural details. They parallel minimum construction requirements of the Federal Housing Administration.

Some time ago, VA put into operation a plan whereby builders are given a pre-construction appraisal of "reasonable value", based upon the plans and specifications, so that they may know in advance the maximum price for which the homes may be sold to veterans with the aid of GI loans. Periodic inspections are made thereafter to insure completion in accordance with those plans.

VA said such pre-construction appraisals will not be issued in advance hereafter unless the plans and specifications meet the prescribed minimum construction requirements. Proposed construction which falls short of these standards will be appraised by VA after completion, and deficiencies will be considered in establishing the valuation.

Correction — Although there was some question involved in award of the contract for construction of water works in TAMPA, FLA., bids were not thrown out as previously reported. Lewis and McDowell, Inc., of New York was low bidder and received the $1,458,000 contract. No discrimination was shown by the City of Tampa in this award. The objection came from local contractors claiming that insufficient time was given them for figuring bids on the job.

MAJOR MEETINGS

National Society of Professional Engineers, annual meeting, Sherman Hotel, Chicago, Ill., Dec. 15-18.

Materials Handling Exposition, Convention Hall, Philadelphia, Pa., Jan. 10-14.

American Society of Photogrammetry, annual meeting, Shoreham Hotel, Washington, D. C., Jan. 12-14.

Associated Equipment Distributors, annual meeting, Stevens Hotel, Chicago, Ill., Jan. 16-20.

American Society of Civil Engineers, annual meeting, Hotel Commodore, New York, N. Y., Jan. 19-21.

Canadian Construction Association, Royal York Hotel, Toronto, Ont., Jan. 23-26.

American Road Builders Association, annual meeting, Willard, Mayflower and Statler Hotels, Washington, D. C., Feb. 7-9.

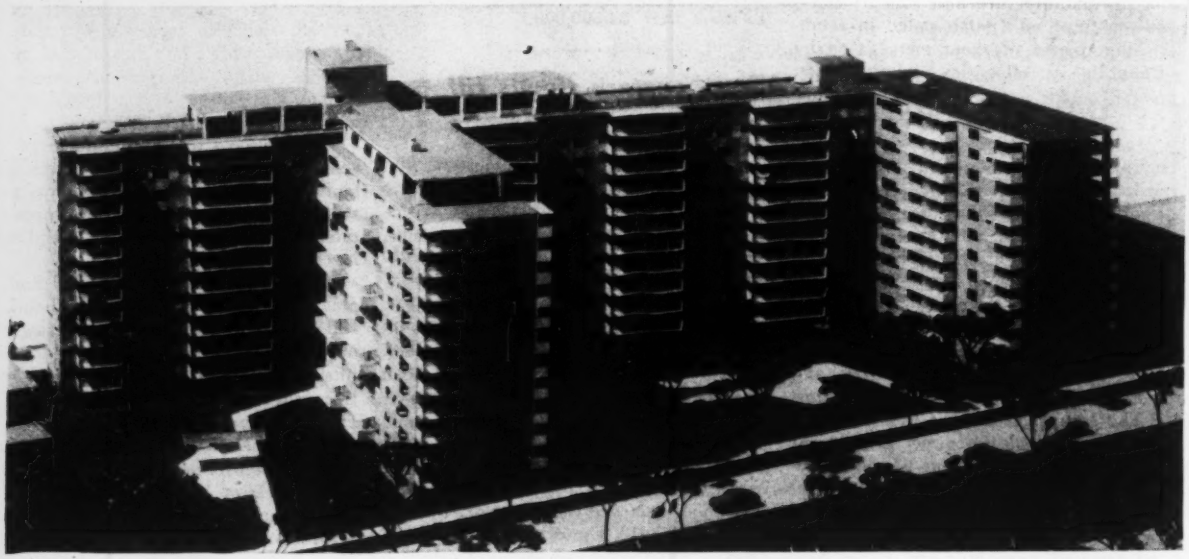
National Ready Mixed Concrete Association, 19th annual convention, Hotel New Yorker, New York, N. Y., week of Feb. 14.

National Sand and Gravel Association, 33d annual convention, Hotel New Yorker, New York, N. Y., week of Feb. 14.

National Association of Home Builders, annual convention and exposition, Stevens Hotel, Chicago, Ill., Feb. 20-24.

American Concrete Institute, 45th annual convention, Hotel Pennsylvania, New York, N. Y., Feb. 22-25.

Associated General Contractors of America, 30th annual national convention, Waldorf-Astoria Hotel, New York, N. Y., Feb. 27-March 3.



UNIQUE DESIGN—This 12-story, 261-apartment building is to be completed in 1950 on the bank of the Charles River in Cambridge, Mass., by New England Mutual Life Insurance Co. Novel design features include glass-walled living rooms with balconies overlooking the river. Elevators will stop only at each third floor and access to apartments on intermediate stories will be provided by private stairways. The 2 1/3-acre site is on the Massachusetts Institute of Technology campus. George A. Fuller Company is general contractor, and W. H. Brown, R. W. Kennedy, Carl Koch, Vernon De Mars, Ralph Rapson, and Dean W. W. Wurster, all of M. I. T.'s School of Architecture and Planning, collaborated with Thomas Worcester, Inc., in the design of the concrete structure.

Thousands of Dollars (000 Omitted)

Public Works	November, 1948 New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	Total U.S.	U.S. Cumulative Eleven Months 1948	1947	% Change '47 to '48	Canada Nov.'48
Waterworks	307	1,135	2,330	7,863	2,752	509	14,896	184,154	125,993	+46	400
Sewerage	1,759	1,313	84	1,735	3,567	1,170	9,628	203,619	161,962	+26	441
Bridges, public	424	6,650	9,416	2,206	2,545	1,141	22,382	257,280	173,759	+48	4,000
Earthwork and waterways	241	1,207	10,570	1,072	16,749	5,548	35,387	475,154	278,028	+71	1,993
Street and roads	1,457	9,790	7,527	12,806	17,649	5,574	54,803	927,193	738,880	+27	3,254
Buildings, public	11,282	22,274	20,561	12,345	14,204	11,802	92,468	1,041,932	551,650	+89	14,193
Unclassified, public	1,262	445	1,859	883	4,430	4,228	13,107	210,966	230,142	- 8	2,929
Total public	16,732	42,814	52,347	38,910	61,896	29,972	242,671	3,300,298	2,260,414	+46	27,210
Federal government (included in above classifications)	194	4,492	17,279	1,220	18,474	12,536	54,195	879,485	569,749	+54	.....
Private											
Bridges, private	.....	468	.....	.....	.....	.....	468	9,143	824	+1,010	.....
Industrial buildings	1,791	7,089	3,464	23,373	15,943	2,984	54,644	1,002,296	817,527	+23	10,191
Commerical buildings	2,395	62,535	16,844	7,580	31,609	7,328	128,291	1,693,131	1,690,623	+01	13,489
Unclassified, private	110	1,962	7,042	5,943	9,618	363	25,038	370,975	386,460	- 4	50
Total private	4,296	72,054	27,350	36,896	57,170	10,675	208,441	3,075,545	2,895,434	+ 6	23,730
Total Engineering Construction											
Nov., 1948 4 weeks	21,028	114,868	79,697	75,806	119,066	40,647	451,112	.....	.....	....	50,940
Oct., 1948 4 weeks	27,293	143,644	90,480	69,504	108,620	208,893	648,434	.....	.....	....	52,025
Nov., 1947 4 weeks	11,172	126,062	81,547	76,456	103,303	75,817	474,357	.....	.....	....	48,090
Eleven months 1948	299,848	1,692,500	988,818	790,541	1,612,809	991,327	.....	6,375,843	.....	+24	480,169
Eleven months 1947	190,168	1,355,017	879,122	709,178	1,222,951	799,412	....	.....	5,155,848	....	430,312
% Change '47 to '48	+58	+25	+12	+11	+32	+24	....	.....	.....	....	+12

Engineering News-Record *reports continental U.S. Construction projects of the following minimum costs-Waterworks, excavation, drainage and irrigation,* $28,000, *other public works* $50,000, *industrial buildings,* $68,000, *other buildings,* $250,000

Nov. construction contract total dips

Construction contracts reported to Engineering News Record in November took a sharp downward turn, to reach the lowest total since January, 1948. Statisticians said they did not look for continuation of the drop, pointing out that early December reports indicate a higher volume.

However, the average per week for November was $112,778,000—30 percent below October's peacetime record average of $162,109,000.

Industrial buildings led the decline, falling to $54,644,000 from the record $209,532,000 in October. But this November volume was still greater than in January, March and July this year.

The four other classes of construction that declined from the previous month are sewerage, down 61 percent; streets and roads, 24 percent; public buildings, 22 percent and earthwork and drainage, 5 percent.

In a geographic breakdown the Far West showed most decline, with industrial building down to $2,984,000 from $136,156,000 in October, public works down to $29,972,000 from $60,598,000 last month. New England contracts declined 23 percent; Middle Atlantic, 20 percent; the South, 12 percent. West of the Mississippi and the Mid West showed gains of about 10 percent each over October.

Cumulative total up

The cumulative contract total for the first eleven months is 24 percent above last year. Public building shows the greatest increase, 89 percent. Increases for other classes of construction range from 0.1 percent for commercial buildings to 71 percent for earthwork and drainage. Geographically, all sections of the U. S. gained over last year. New England gained most, 58 percent.

New construction capital, $529 million in November, was exceeded only in July this year—a five-week month. Corporate securities came to $231 millions, exceeding October by $7,000,000. Public utilities obtained nearly $170 millions, or 73 percent of this total—the Michigan-Wisconsin Pipe Line Company borrowing nearly $66 millions.

States and municipalities obtained $298 millions for construction in November. About 61 percent of this total will go for public buildings—of which over one-half are temporary housing loans. New York City Housing Authority raised the largest sum by far—$62,000,000. California raised nearly $10,000,000 for housing, while Massachusetts, Connecticut, Pennsylvania, Rhode Island and Virginia, issued notes for about $5 millions each.

CONSTRUCTION ACTIVITY

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Dec.'48	477.66	229.61
Building Cost	Dec.'48	355.55	192.20
Volume	Nov.'48	203	89

Activity This Week

as surveyed by ENR

Amount of contracts let

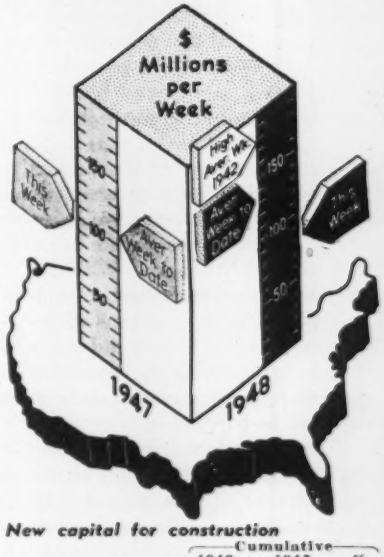
(millions of dollars, continental U. S. only)

	Week of Dec. 9 1948	Cumulative 1948 (50 wks.)	1947 (50 wks.)	% Chge
Federal	$6.2	$897	$619	+45
State & Mun.	47.0	2,531	1,784	+42
Total Public	$53.2	$3,428	$2,403	+42-43
Total Private	30.5	3,394	3,062	+11
U. S. Total	**$83.7**	**$6,822**	**$5,465**	**+25**

Contracts by type of work

	This Week	Cumulative 1948 (50 wks.)	1947 (50 wks.)	% Chge
Waterworks	$1.7	$189	$137	+38
Sewerage	3.9	220	170	+29
Bridges	9.5	286	187	+53
Highways	12.8	957	777	+23
Earthwork, Waterways	5.2	488	314	+55
Buildings, Public	16.5	1,078	578	+87
Industrial	3.8	1,037	835	+24
Commercial	24.3	1,771	1,831	−32
Unclassified	6.0	796	636	+25

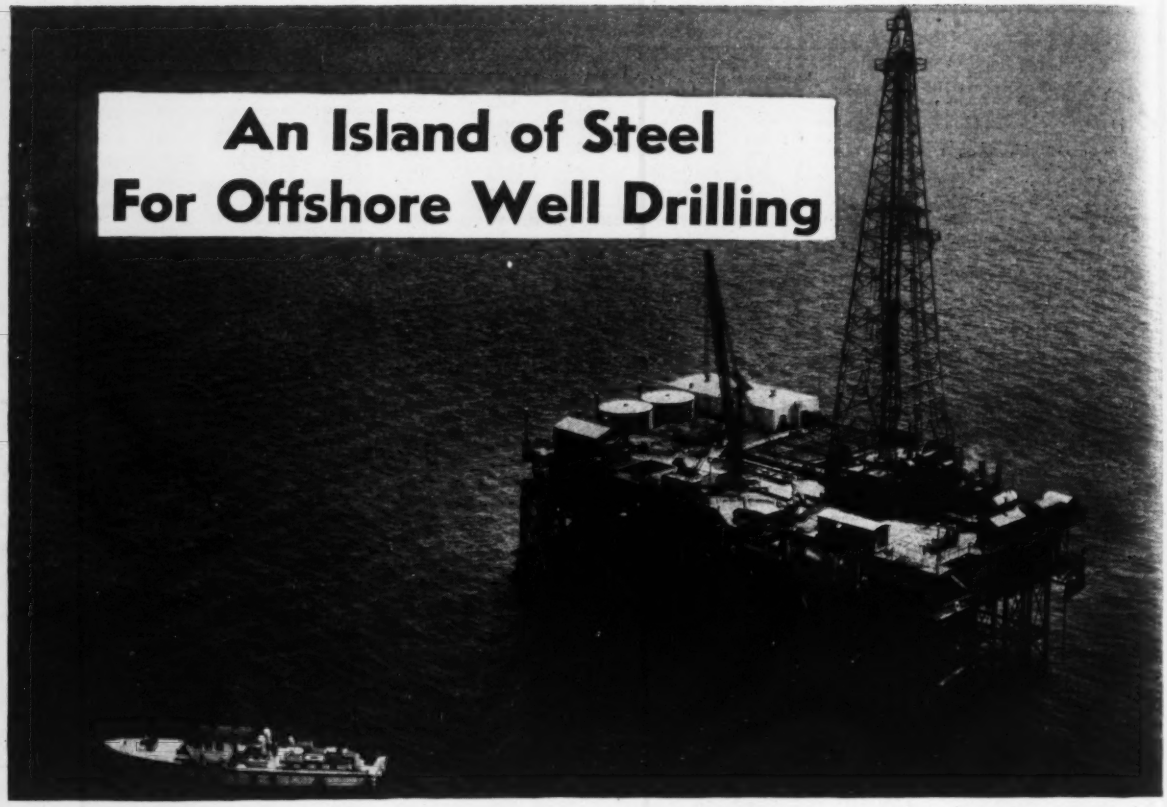
NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.



New capital for construction

	Cumulative 1948 (50 wks.)	1947 (50 wks.)	% Chge
NON-FEDERAL	$4,873	$2,494	+95
Corporate Securities	2,450	1,126	+18
State and Municipal	1,931	1,120	+73
U. N. Building Loan	65	.....	.....
Fed. Aid Highway	427	248	+72
FEDERAL	1,559	819	+90
Total Capital	**$6,432**	**$3,313**	**+94**

An Island of Steel For Offshore Well Drilling



SUPPORTED ON 196-FT. STEEL PILES in 48 ft. of water, 206x110-ft. double-deck platform has quarters for 54 men.

S. W. Oberg
Chief Civil Engineer, Production Department
Humble Oil & Refining Co., Houston, Texas

As the search for new oil reserves progresses from the swamps and shallow inland waters of the coastal region into the deeper exposed waters of the Gulf of Mexico, it magnifies the problems of design and construction of suitable marine-drilling platforms. The practical and economical solution of these problems offers the engineering profession and construction industry many opportunities for profitable application of their greatest skill and ingenuity.

The biggest marine platform to date is an example of this challenge. It is the 206x110-ft. double-deck, all welded steel drilling platform recently completed by the Humble Oil and Refining Co., in the Gulf of Mexico about 8 mi. southeast of Grand Isle, La.

Located in 48 ft. of water, this $1,232,000 half-acre steel island almost defies imagination. Significant design features include: Total dead and live load of 10,000,000 lb.; wind velocity of 125 m.p.h.; 32-ft. waves creating a total wave force of 1,103,-200 lb.; and 196-ft. steel piles to carry 126-ton loads.

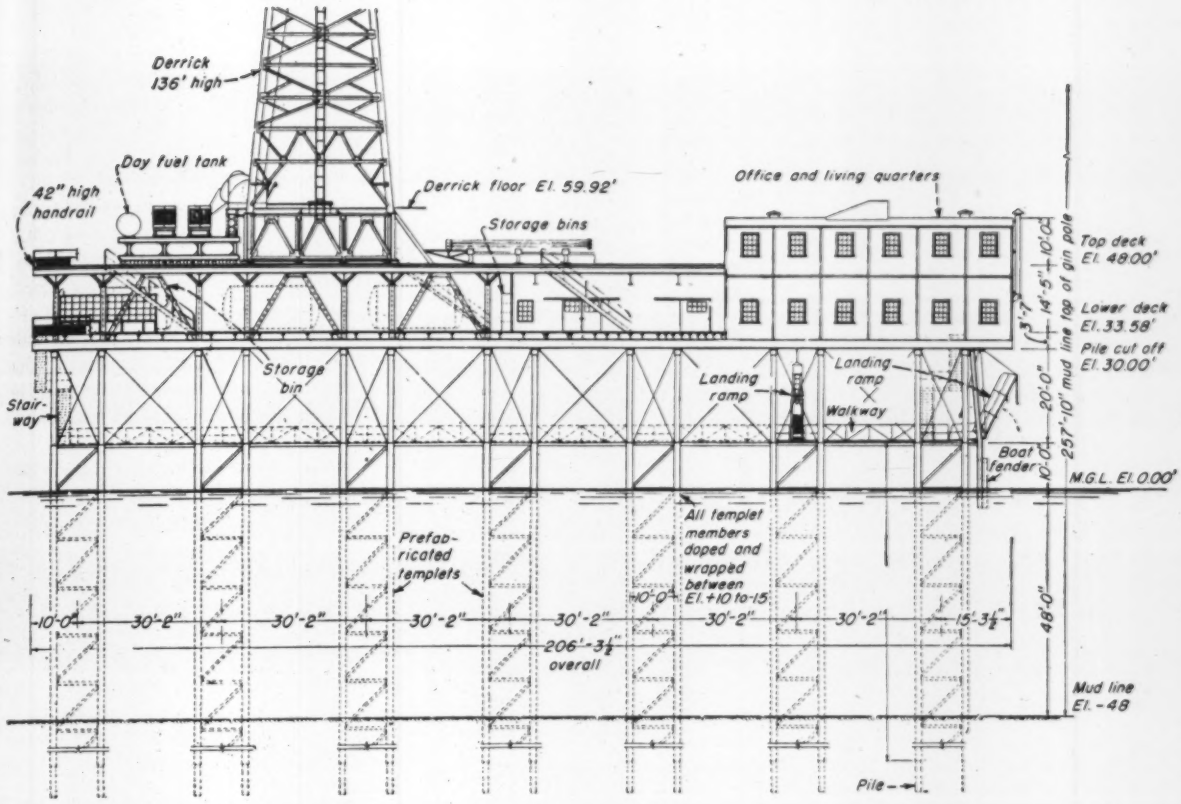
The platform, with its drilling rig facilities and personnel, forms a small island community within itself. In addition to the derrick, drilling rig, equipment and supplies located on the platform, living quarters with all conveniences and facilities are provided for a resident crew of 54 men. Provisions for safety to personnel, equipment and operations were given paramount consideration in planning the operation and in designing the platform. Such precautions increased the cost of the project, but it is believed that experience gained from this initial installation will result in cost reductions in future work.

Prime requirement of the platform is to provide adequate support for the anticipated loads, with ample space and facilities to accommodate the drilling rig, fuel, water, pipe, food, other supplies and living quarters. Also, it was designed to permit continuous operations for long periods of time without replenishment from outside source, since normal transportation may be interrupted by hurricanes, rough seas or other weather phenomena.

Design loads

The useful loads to be supported, with their arrangement and space requirements, were planned to accommodate the largest and most powerful drilling rig assembled by Humble to date. Uniformly distributed deck loads vary from a minimum of 100 lb. per sq. ft. in parts of the living quarters area to 1,000 lb. per sq. ft. in storage area.

Approximately one-acre of floor space is required on the two decks. The drilling rig, derrick, pipe racks, electric generating plant, fire pumps, 1,000 bbl. of fresh-water storage,



UNDERWATER BRACING followed an old and well-proved method of reducing the slenderness ratio of the long columns—prefabricated towers, each 72 ft. high and enclosing four piles, extend from the lower deck to well below the mud line. The platform was oriented broadside to the prevailing wind for maximum operational safety.

stiffleg derrick, repair shop, change room, and a part of the living quarters with office and radio station, are located on the upper deck, 48 ft. above Mean Gulf Level. The lower deck is 33.6 ft. above mean water level and supports the mud pumps, fuel and water storage tanks, mud storage, food storage, boiler station, laundry, area for seven wells, and crews' quarters with recreation and dining facilities.

Original provisions for 14 wells and a gantry crane on the top deck were revised during construction by reducing the number of well locations to seven and substituting a stiffleg derrick for the gantry crane. To facilitate movement of the derrick to the various well locations, the 30 ft. 2 in. by 30 ft. 2 in. base dimension of the derrick was used as the basic pattern for the bays of the platform.

Facilities required and operations provided for on the platform also consist of mooring and anchorage for vessels servicing the operation, and loading facilities. In addition there are a cold storage plant, heating and ventilating systems, and sanitary sewage disposal for the living quarters.

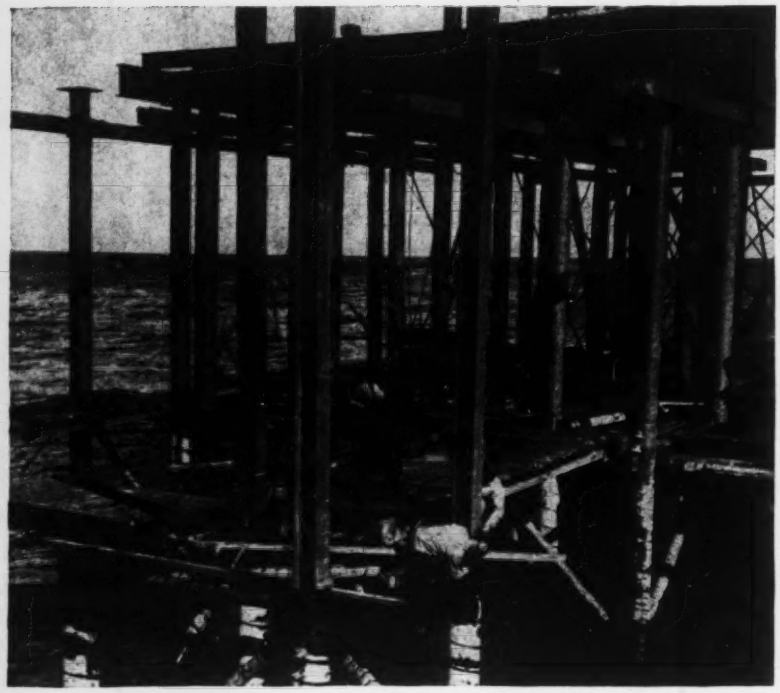
Exposure to wave and wind action of tropical hurricanes required design of the platform to resist the forces of these elements. From exhaustive studies of all available data on wave forces, and consultation with Dr. W. H. Munk and C. J. Burke of the Scripps Institute of Oceanography, it was predicted that a maximum wave height of 32 ft. could be reasonably expected at the location. Accordingly, the lower deck was placed above the crest of such a wave accompanied by a 5 ft. storm tide. Total wave force on the platform was computed to be 1,103,200 lb. Wind velocity of 125 m.p.h. was used for design of the platform and a wind pressure of 40 lb. per sq. ft. for design of the buildings.

Platforms investigated

During preliminary planning, designs to withstand such forces and loads were completed for several types of platforms. Numerous patented devices were investigated, some of which no doubt were feasible, but were unsuitable due to certain limitations. Final design of the platform to resist the large lateral loads of the elements and to support the maximum operating loads resorted to an old, well-proved and much-used method of underwater bracing to reduce the slenderness ratio of the supporting piles.

A four-pile tower bent or braced unit suggested by the contractor was adopted as the basic unit of construction for the foundation. Each unit is a 10x10-ft. tower 72 ft. long for four piles, and extending from 10 ft. above water to well below the mud line. To reduce the absorption of wave forces by the platform, the towers are fabricated of tubular material, 6-in. pipe being used for bracing and 16-in. pipe for the legs of the towers through which sectional 57-lb. H-piles were driven.

The tower units, spaced on 30 ft. 2 in. centers, are braced to each other at their tops by pin-connected 8-in. pipe struts. The piles have shields of 16-in. pipe above the towers, connecting to the tops of the towers and cross-braced to each other by tension rods above the towers so that the



THE 196-FT. H-PILING were guided into the four legs of the prefabricated tower templates, while the installation of shields, struts, caps, and deck beams followed progressively after the piles had been driven to the required resistance.

four piles of each tower act as a unit. Design of the pile caps and deck beams with the 8-in. pipe struts and tension rods provides for portal action of the piles and the template tower units.

Friction-pile foundation

The major factor in selecting the friction-pile type of foundation for the platform was the character of soil below the floor of the Gulf at the location, which required an extensive investigation. A sectional test pile, of 24-in. O.D., ½-in. thick wall steel pipe 224 ft. long, was driven to practical refusal with a steam hammer having a striking energy of 30,225 ft.-lb. at a penetration of 164 ft. below the floor of the Gulf. A prefabricated platform 20 ft. square was installed on the top of the test pile 12 ft. above the water. A portable rotary coring rig then was placed on the platform and undisturbed soil cores were obtained from the bottom of the Gulf to a depth of 348 ft. below Mean Gulf Level. Undisturbed cores also were obtained from five other core tests drilled along the shore.

From laboratory test and analysis of the soil cores, under the direction of Prof. Raymond F. Dawson of the Engineering Research Section at the University of Texas, a foundation of long friction piles was selected. Ultimate bearing capacity of the test pile was calculated to be 400 tons from the driving characteristics and 375 tons from laboratory analysis of the cores. Average bearing capacity per pile for the template varied from a minimum of 46 tons in the area of the living quarters to a maximum of 126 tons under the mud storage area.

To prevent delay in construction of the platform, the 57-lb. H-piles were substituted for 14-in. tubular piles, originally proposed. These sectional piles, 280-ft. long, were driven to penetrations ranging from 154 ft. to 196 ft. as required to support the design loads. Bolted splices with supplemental welding were used to connect the pile sections, which consisted of one 120-ft. lead section and three additional 53-ft. 4-in. sections.

Another fundamental requirement in developing the design of the platform was permanency of installation. A permanent-type platform, capable of lasting 30 years or more to serve production operations, would be required in the event oil production was obtained.

To provide initial protection during the exploration period of operations, the drilling platform above elevation +10 ft. (Mean Gulf Level) received protective coatings of zinc-chromate primers and paint. The template towers were doped and wrapped with three coatings of coal tar pipeline enamels and two wrappers of Fiberglass from elevation +10 ft. to −15 ft. Also, the entrapped salt water inside the pipe around the H-piles was neutralized with a caustic soda solution and sealed with a heavy oil.

Cathodic protection for the submerged part of the platform and encasement of the steel piling in concrete is planned to increase its life as required for production operations.

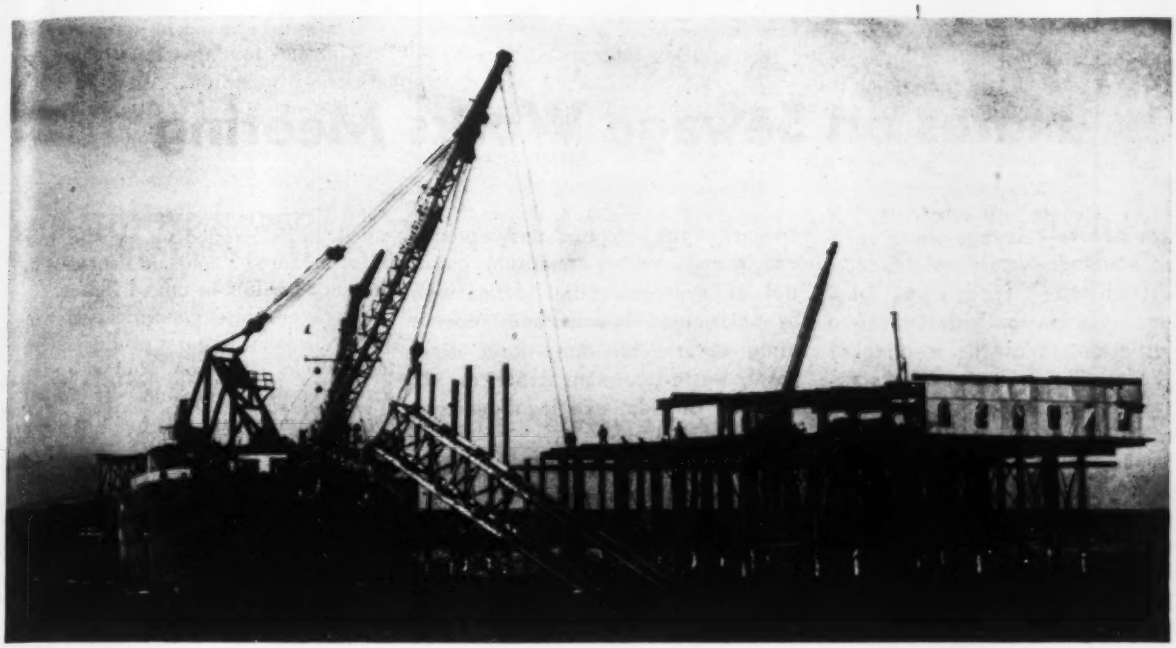
Safety measures emphasized

Safety measures were given much consideration in the design. To reduce the danger of fire from the fuel system for diesel oil, the only combustible liquid on the platform, a fire water-system with diesel and electric pumps is provided in addition to chemical and foam-type fire extinguishers.

The platform was oriented broadside to the prevailing wind to provide safer operating conditions. Timber-clad steel fenders were installed on one side and one end of the platform for protection from service vessels. To reduce the hazards of transferring personnel to and from the platform, special counter-weighted personnel ramps were installed on all sides of the platform. These ramps, extending from walkways on the platform below the bottom deck are hinged and pivot-mounted to permit movement in both horizontal and vertical planes. They also are equipped with a hinge-mounted boarding ladder on the free end to permit variations in distance from the vessel to the platform.

The platform was designed for economical salvage and easy removal to meet the requirements of the Corps of Engineers. Prefabrication was utilized wherever practical. Standard rolled sections of structural steel beams were used for pile caps and floor beams with conventional creosoted timber decks. Welded construction was utilized throughout.

Design was planned to permit practical construction, which would be



THE 18-TON TOWER TEMPLATES, prefabricated at an inland base in New Orleans, were transported to the site on converted LSM ships and lowered into position by a 50-ton revolving crane, mounted on a converted LST vessel.

economically feasible, consistent with the requirements, and which would not involve special construction equipment, complicated or hazardous construction.

The platform was fabricated of wide-flange steel beams. It is supported on 100 ten-inch, 57-lb. bearing piles driven in 25 prefabricated towers 10-ft. square. Towers are 30 ft. 2 in. c. to c. They are capped longitudinally with 24-in., 76-lb. beams, with transverse portal of 24-in. 76-lb. beams between each pair of caps on piles in the same templet tower. Deck beams, of 12-in., 36-lb. beams extend across the longitudinal caps in the transverse direction of the platform for the lower deck and are spaced as required to support the deck loads.

The top deck is supported on 50 wide-flange steel columns mounted on the transverse portals between pairs of pilings. Columns are capped with 30-in., 116-lb. beams running transversely across the structure. The top deck is made up of 16-in., 36-lb. beams placed in the longitudinal direction of the platform and spaced 5 ft. c. to c. Special beams for the derrick support consisting of double 21-in. wide-flange beams with cover plates are placed across the 30-in. column caps parallel with the beams on the top deck. The floor of the top deck is 3-in. creosoted timbers spiked to 4x8-in. creosoted nailers, bolted to the steel deck beams.

Prefabrication was used wherever practical for the structural parts of the platform as well as for the living quarters and other buildings.

Actual construction was started on Nov. 30, 1947. The platform, buildings, and facilities, containing 1,920 tons of steel, including 25 prefabricated template towers with 100 bearing piles, was completed within 107 days, including 17 days lost time due to rough seas.

Construction equipment on LST

Conventional construction equipment mounted on a converted LST vessel, 327 ft. long with a 51-ft. beam, was used by the contractor for housing the construction crew, storing materials, and erecting the platform. Tugs and barges of converted LSM vessels transported materials to the location and serviced the operation.

A combination lump-sum and cost-plus-fixed-fee contract was used to relieve the contractor of the risk and cost of the marine construction operations. The lump-sum price for material, fabrication, and loading, covered conventional construction work on land and permitted competitive bidding. The fixed fee covered the contractor's fee, profit and equipment rental for erection of the platform. Direct cost of the field erection or hazardous marine operation was borne by the owner. Although thus relieved of much of the risk, the contractor still had a definite incentive for early completion of the work.

Studies indicate that no one type of platform is feasible or economical for all locations or conditions, and that each location requires a separate analysis, due to foundation conditions, drilling practice, and program, position in the Gulf, depth of water, and distance from base of supply.

The present trend in exploratory drilling on the continental shelf is toward the use of smaller single-deck platforms to accommodate the derrick and a minimum of drilling equipment with space for not more than three well locations for operation in conjunction with shipboard auxiliary equipment, facilities, supplies, and living quarters provided on a ship moored at the location.

Construction of the platform and plans for the drilling rig arrangement were under the direction of the civil engineering and petroleum engineering divisions, respectively, of the production department of the Humble Oil & Refining Company. Basic design, fabrication and erection of the platform were performed by W. Horace Williams Co., New Orleans, general contractor.

Notes on Sewage Works Meeting

Editor's Note—Sewage-plant operation, sewerage-system maintenance, industrial-waste treatment and stream-pollution activities received major attention at the meeting of the Federation of Sewage Works Associations held in Detroit, Mich. on Oct. 18-21.

Among the 17 technical papers those of broad interest to sanitary engineers and municipal administrators are abstracted in this report. These discussions deal with effects of synthetic detergents on sewage treatment, operating efficiencies of the activated-sludge process, sewage-biology research, control of hydrogen-sulfide formation by chlorinated hydrocarbons, operating criteria for dairy-waste disposal, waste-treatment practices in Ontario, Canada, and legal indices of stream pollution.

Information on availability of complete papers may be obtained from W. H. Wisely, executive secretary of the Federation at 325 Illinois Building, Champaign, Ill.

A news story on the conference was published in *ENR*, Oct. 28, p. 75.

HOW DETERGENTS AFFECT SEWAGE TREATMENT

Research results indicate that synthetic detergents in sewage indirectly affect treatment processes but are not toxic to biological activities. In general, replacement of soaps by detergents will reduce strength of sewage, decrease efficiency of settling tanks and thus increase load on secondary devices, cause foaming, floc agglomeration and carry-over in activated-sludge units, and reduce gas formation in sludge digesters.

Two groups of synthetic detergents were used in the research: Cationic (quarternary ammonium) compounds and two types of anionic compounds—fatty alcohol sulfates. (Dreft, Swerl, Coop, Vel) and sodium alkyl aryl sulfonates (Nacconol NR).

Effect on sewage strength—Some detergents are slightly acid; others are slightly alkaline. BOD of detergents ranges from none to 500,000 ppm. but is substantially lower than soaps. It is estimated that if soaps were entirely replaced by detergents, actual BOD of sewage would decrease 15 to 40 ppm., depending on detergent used.

Effect on settling—With increasing concentrations of detergents, more suspended solids remained in settling-tank effluent. The increase was almost in direct proportion to amount of detergent added.

Effect on sludge volume—Detergents have no measurable effect on volume of sludge produced with the exception of Dreft. Despite lower suspended-solids removal, Dreft produced 7-18 percent more sludge than other detergents.

Effect on grease removal—Detergents do not form precipitates and prevent precipitation of soaps. Four experiments with three detergents showed increasing amounts of grease in effluent.

Effect on BOD removal—Although BOD generally increased with addition of varying quantities of several detergents to different sewages, percentage removal of BOD was not materially affected.

Toxicity of detergents—Up to 1,000 ppm., detergents do not interfere with sewage oxidation and cause little, if any, retardation of biological activity in quantities equivalent to normal soap concentrations.

Effect on activated sludge—Tests were made on well-settled and bulking activated sludge both with low and average solid concentrations in mixed liquor.

With increasing quantities of Nacconol NR, sludge index decreased gradually but suspended solids and BOD in effluent increased. Considerable foaming, which increased with increasing amounts of detergent, resulted. Floc carried up by and lost in foam caused a constant decrease in suspended solids in mixed liquor.

Average-solids concentration of Vel in mixed liquors produced no measurable effect on sludge index or degree of purification. It caused some foaming in 50 to 100-ppm. concentrations.

When added to bulking sludge, Dreft and Nacconol caused definite decrease in sludge index but no effect on suspended solids in effluent. These chemicals tended to increase BOD, aggregation of floc and considerable foaming.

Coop, added to bulking sludge, caused large decrease in sludge index. Separation between sludge and liquid was improved. With increasing concentrations of the detergent, suspended solids and BOD in effluent increased, and effluent became more turbid.

Effect on digestion—Volatile-matter destruction, grease reduction and gas production were not materially affected by addition of detergents to sludge. Rate of digestion may be more rapid with detergents.

The effect of detergents on sewage-treatment processes is not uniform. Some detergents produce greater effects than others.

Effect on trickling filters

Principal effect on trickling filters is increase of grease and fine particles in settling-tank effluent, thus causing a heavier load on filters. When load on filters is approaching maximum capacity or is excessive, this condition may cause a decrease in degree of purification.

In activated-sludge plants, detergents cause foaming, floc agglomeration and carry-over of suspended matter. The foam is tough and contains much fine suspended matter. Large amount of foam remains on surface of settling tank, passes over weirs and impairs effluent.

Agglomeration produces leathery pieces of floc which cling to tank walls and settle rapidly. This action

requires more turbulence or air to maintain particles in suspension.—*Willem Rudolfs, chairman, Department of Sanitation, N. J. Agricultural Experiment Station, New Brunswick, N. J.*

ACTIVATED-SLUDGE TREATMENT

Based on operating results from 26 activated-sludge plants averaged over one-to-six year periods, 92.5-95.0 percent removal of biochemical oxygen demand and suspended solids may be anticipated in properly designed units treating domestic sewage.

Two major factors affect efficiency of the activated-sludge process: quantity variations and chemical characteristics (industrial wastes) of sewage. More research on these factors is needed before methods can be devised to control their effect on plant efficiency.

Other factors, on which some progress has been made in determining effect on plant efficiency, are: suspended-solids concentration in aeration tanks, quantity of air, and aeration-contact period. In addition, interrelation of temperature, nitrification, character of returned activated sludge referred to biological activity and BOD loading per unit of aeration-tank volume must be evaluated before the influence of these operating conditions can be defined.

Better design and operation of primary-sedimentation tanks would result in higher treatment efficiencies. Insufficient capacity, inadequate hydraulic design and return of excessive quantities of waste activated sludge and digester supernatant liquor cause many plant upsets.

Further study of operating data supported by laboratory research is needed to determine effects of temperature, chemical constituents of untreated sewage, nitrification with reference to BOD, and aeration-contact time on plant performance.

To facilitate study of plant performance, operating data averaged more than a week but less than a month should be made available.

Plant operators should collect more complete information on chemical content of sewage, and at least determine amount of nitrogen in the influent and effluent. They should also provide a true measure of character of sewage entering a plant including sludge and supernatant recirculated through primary tanks.

Improved laboratory techniques for BOD are desirable to eliminate undesirable double or multiple reactions in test bottle during incubation. Now under study, a more accurate BOD test would aid in determining interrelation of several operating factors.—*William E. Stanley, professor of sanitary engineering, Massachusetts Institute of Technology, Cambridge, Mass.*

SEWAGE-BIOLOGY RESEARCH

While sewage has been treated for more than 50 years, too much is still unknown about the biological nature of domestic wastes. The basic need for better treatment processes today is intensive research in sewage biology. This need poses a challenge to bacteriologists, mycologists (botanists dealing with fungi) and zoologists for investigation of sewage-treatment micro-organisms.

Precise biological information is needed on (1) Species of organisms working in treatment processes; (2) the relative abundance, numerically and volumetrically, of each species so that no important organism is neglected; (3) the range of environmental conditions under which each species functions; and (4) the work accomplished by each organism, whether a small or large segment of the purification process.

Large plants can support biologic research as well as other experimental work. Correlation of findings will go far toward standardization of tests and interpretation of results.—*James B. Lackey, scientific editor, The Blakiston Company, Philadelphia, Pa.*

CHLORINATED HYDROCARBONS AND HYDROGEN-SULFIDE CONTROL

Studies to determine the extent to which chlorinated hydrocarbons added to sewage inhibit production of hydrogen sulfide consisted of two parts: A comprehensive review of related literature and extended laboratory investigations.

A search of scientific literature indicated that hydrogen sulfide is produced by two processes: Reduction of sulfates solely by *Sporovibrio desulfuricun* organisms and decomposition of organic matter containing sulfur, such as proteins and their derivatives. These organic compounds, which are always present in domestic sewage, are readily decomposed by microorganisms such as the coliforms.

Results of the laboratory research are:

1. A new laboratory technique, which evaluates inhibitory properties of organic and inorganic compounds in biochemical production of sulfides accurately, was developed.

2. Initial production of sulfides in sewage usually occurs in biochemical reactions in which mixed population of sewage organisms, such as the coliform group, consume sulfur-containing organic compounds. In addition, the reactions lower the oxidation-reduction potential of sewage.

3. Secondary production of sulfides occurs when oxidation-reduction potential is lowered to 200 to 300 millivolts. In this range *Sporovibrio desulfuricans* will reproduce in effective numbers to reduce mineral sulfates to sulfides.

4. Chlorinated hydrocarbons, such as orthodichlorobenzene, when properly emulsified, will inhibit initial production of hydrogen sulfide in sewage, and keep sewage relatively fresh long enough to permit passage through a sewer system.

5. A 75 percent inhibition of sulfide production may be achieved for 18 hrs. at 37 deg. C. in a normal domestic sewage when the chlorinated hydrocarbons emulsion, *Cloroben*, is present in a concentration of 1 ppm.

6. Concentrations higher than 1.0 ppm. do not increase inhibitory effect to any appreciable extent when applied to normal domestic sewage.

7. High concentrations of sulfate-reducing organisms and septic conditions (low oxidation-reduction potentials) nullify inhibitory effect of chlorinated hydrocarbons in sewage and specific synthetic media.

8. Sulfide production by reduction of mineral sulfates cannot be controlled by small dosages of chlorinated hydrocarbons. It must be controlled by removal of *Sporovibrio-desulfuricans* sources, such as sewer slimes.

9. Sulfide production by decomposition of sulfur-containing organic compounds by sewage organisms, such as those of the coliform group, can be controlled by addition of small dosages of chlorinated hydrocarbons.

Laboratory investigations were concentrated on use of the emulsion, orthodichlorobenzene (*Chloroben*) to inhibit hydrogen-sulfide formation. This was done to permit correlation of laboratory studies with actual operating results of large sewer systems, such as Los Angeles, Calif.—*Rolf Eliassen, professor of sanitary engineering; Austin V. Heller, research associate; and Ger-*

hard Kosch, research fellow; New York University, New York, N. Y.

OPERATING AND MAINTAINING SEWERS

Sewers in Milwaukee, Wis. are operated by the Division of Maintenance, Bureau of Sewers. Other divisions of the bureau are: Construction, engineering and accounting.

The Division of Maintenance, which is administered by a field and assistant-field superintendent, cleans, flushes and repairs all sewers and constructs catch basins, storm inlets and overflows.

To operate the sewer system, the city is divided into three districts, each headed by a supervisor who reports directly to the field superintendent.

District personnel consists of two or three construction gangs each with a foreman and 8-10 laborers, a catch-basin cleaning crew, one or two sewer-cleaning crews, a flushing crew, one or two masons plus helpers, a troubleman and timekeeper.

At the division headquarters, a blacksmith, carpenter, and machinist, all with helpers, provide specialized service for the districts. Also on the division staff are two sewer-examining crews.

Services provided by the district crews are:

Construction—Small repairs and replacements to sewer structures.

Catch basins—Catch basins are cleaned yearly. In 1947, 19,262 units were cleaned by eductors and 5,099 catch basins, not accessible to eductors, were manually cleaned. Each eductor, which can handle about 20 catch basins per day, operates about eight months a year due to winter conditions. During the remaining four months all cleaning is by hand.

Foremen are supplied with sectional maps showing catch basins and storm inlets. After servicing, he returns the maps with notations to show date of cleaning and structural conditions to headquarters.

Sewer cleaning—Sewers are cleaned regularly and on recommendation of the examining crew. Sewers under busy streets are cleaned at night.

Flushing—Storm inlets are flushed yearly with fire-hydrant hose. As this is troublesome, use of a mobile power flusher is being studied. Sewers are flushed on basis of information received from examining crews.

Masons—Four masons with helpers are employed year round by the Maintenance Division to set catch frames and repair brick manholes and sewers.

Troubleman—The troubleman investigates all complaints in his district, calls the nearest labor crew to open plugged sewers and catch basins, and in a pick-up truck delivers materials and moves crews during slack periods.

A troubleman and two helpers are on duty Saturdays, Sundays and holidays. One troubleman is always on night call.

Sewer examining—These crews examine sewers regularly for structural conditions, flow and depth of deposits. Maintenance and repair work is based on reports resulting from the examination.

Previous to repavement of streets, all sewers are checked carefully to determine if reconstruction is necessary.

Small sewers are examined with lights and mirrors. Men crawl through all sewers 30-in. and larger when flow permits. Occasionally 24-in. sewers are inspected in this manner.

Safety belts are used in deep manholes and boots, rubber suits, aluminum ladders and safety lamps are provided.

The maintenance division employs 160 men. Salaries are as follows: Common laborers, $140 per month; construction laborers, $150; sewer examiners, $165; foremen and troublemen, $180; construction foremen, $210; and field superintendent, $350. All salaries are adjusted upward with a cost-of-living bonus of $83.02 per month.

All city-owned equipment—auto, trucks, trailers, air compressors, eductors, concrete mixers and cranes—are operated and maintained by the Bureau of Municipal Equipment. This equipment is rented to other bureaus at rates somewhat less than those charged by private firms.

Special equipment, such as pumps, cleaning machines and steamers, are owned and operated by the Bureau of Sewers.

The 1948 budget for sewer maintenance totals $529,459. This provides $480 per mile of sewer.—*Fred H. Burley, superintendent, sewage treatment plant and W. M. Wallace, superintendent of water filtration and sewage treatment, Detroit, Mich.*

DAIRY WASTE DISPOSAL

Studies of activated-sludge treatment of wastes from the Belle Center Creamery & Chase Co., Belle Center, Ohio indicate the following operating criteria:

1. Minimum aerator capacity—to insure effluent BOD consistently less than 50 ppm.—should be 80 gal. per lb. BOD per day where aerator-clarifier ratio is 1 to 1.
2. Volumetric detention period should be about 16 hrs. based on raw-waste flow for a typical dairy waste containing 1,000 ppm. BOD.
3. Dissolved oxygen content of 1-4 ppm. in aerator and a trace more in clarifier must be maintained.
4. Percentage of return sludge depends on BOD concentration. While much research is necessary to establish return-sludge to raw-waste ratio, it appears that, with 800-1,000 ppm. BOD, return-sludge flow will range from 600 to 700 percent of raw waste.
5. Required suspended-solids concentration in mixed liquor will vary from 5,000 to 6,000 ppm. when waste has BOD indicated in item 4.
6. Optimum settling characteristic of solids in mixed liquor appears to be that which will produce about 300 milliliter of sludge per liter of liquor in one hour. With a 1:1 aerator-clarifier ratio, liquor with settling rates as high as 800 ml. per liter per hr. usually resulted in satisfactory effluent. Effluent from slow-settling or bulky sludge usually was better clarified than with sludge that settles too rapidly.
7. Optimum air requirement, using jet diffusers, was about 1 to 1.2 cfm. per lb. BOD per day. Pre-aeration required about 0.5 cfm. per lb. BOD per day to prevent septivity and odors.
8. Excess sludge volume, which averaged about 3,300 gal. per day, was reduced in a concentrating tank to about 1,300 gpd.
9. Detention period in digester was about nine days. Although it was not necessary to draw sludge for a year, solids were apparently liquefied and gasified completely. Digester temperature was held at 90 deg. F. using steam from the creamery.

Process wastes at Belle Center are delivered from the plant to an equalizing sump where air is introduced to prevent septic action. Two pumps lift the pre-aerated material to a division box from which flow is into two parallel systems.

Each system consists of an aeration tank, equipped with jet diffusers and compartmented to preclude short circuiting, and a clarifier. Effluent from clarifiers is discharged over weirs to the outfall sewer.

Return sludge from clarifier is pumped by an air lift to a weir box from which it passes to the aerator.

Excess sludge is collected in small concentrating tanks and after volumetric reduction is pumped to digesters.

Total capacities of units are: Preaeration sump—12,500 gal.; aeration tanks—23,760 gal.; clarifiers—23,950 gal.; and digesters—11,450 gals. *—E. F. Eldridge, chief engineer, State Pollution Control Commission, Olympia, Wash.*

WASTE TREATMENT IN ONTARIO

Sewage-treatment and waste-disposal projects are being accomplished in the Province of Ontario, Canada without financial aid from the provincial or federal treasury.

Construction of local projects is being pushed by health groups and others interested in use of streams so strongly that public appreciation of the need for stream sanitation is greater than ever before. In addition, the Public Health Act assigns mandatory power to the provincial health department for compelling construction of essential disposal works.

Municipal Sewage Treatment—As the present status of municipal sewage-treatment works is not satisfactory, the policy of the Provincial Department of Health is to eliminate all water pollution. This will necessitate enlargement of overloaded facilities and construction of new plants where raw sewage is now discharged directly to streams.

All new sewer systems must include treatment plants of sufficient capacity to meet local needs. This ruling applies to private, municipal and industrial systems.

Sewage facilities now under construction include a number of small sewerage systems, extension of sewers in many communities and an 80-mgd. primary-treatment plant that will cost $9,000,000.

Industrial Wastes—Chemical rather than bacterial pollution has acquired new prominence in connection with industrial wastes. Milk, canning, paper, steel-mill, oil, rubber, and gasworks wastes have proved particularly troublesome.

Where major industrial wastes are encountered, the prevailing policy requires either separate treatment and disposal or preliminary treatment prior to discharge in public sewers.

Design Practices—Current design practice in Ontario indicates a trend toward more complete treatment. Mechanical equipment is being widely used and sludge digestion has been incorporated in all recent plants. Mechanical dewatering is employed in some cases. Both activated sludge and high-rate trickling filters are being used to provide secondary treatment. Chlorination of effluents as well as disposal of liquid or dewatered sludge fertilizer is increasing.

Financing—Sewer-rental financing is being adopted with increasing frequency. This procedure is being employed in conjunction with property taxes to meet construction obligations. Additional revenue provided by increased water rates is also favored.—*Albert E. Berry, director, Sanitary Engineering Division, Ontario Department of Health, Toronto, Ontario, Canada.*

WHEN ARE STREAMS POLLUTED?

A study of court cases indicates that 28 conditions and materials have been recognized legally as causing pollution of streams. Among these conditions are:

Noxious and noisome slime on banks and bed of a stream; wastes that cause foul odors; odors that are carried two miles on either side of a stream; deposition of offal, filth and noisome substances; discharges of chemicals or deleterious substances that kill fish, create noxious vapors or provide breeding places for large numbers of flies or insects; sewage discharges into water so that cattle will not drink it; milky distillery wastes; wastes that settle and decompose into sludge; small quantities of polluting substances; oil discharges changing taste of water; dyes causing stream discoloration; discharges of soap, soda ash, soda salts, blue vitriol, lead, arsenic, poisonous mining wastes, caustic soda, petroleum, and methyl alcohol; wastes that cause pipe corrosion or skin irritation; saltwater or mine-wash discharges that ruin water supplies; and disposal of wastes that contaminate ground or surface water supplies.

State laws governing pollution of streams in the cases studied are generally no more rigid than precedents established by the court decisions.

More court evidence showing condition of streams is needed. Complete compilation of all available evidence that shows condition of streams declared by court to be polluted would materially aid engineers and industrial managers concerned with pollution of streams.—*Don E. Bloodgood, professor of sanitary engineering, Purdue University, Lafayette, Ind.*

Coal Producers Raise Use Of Motor-Truck Haulage

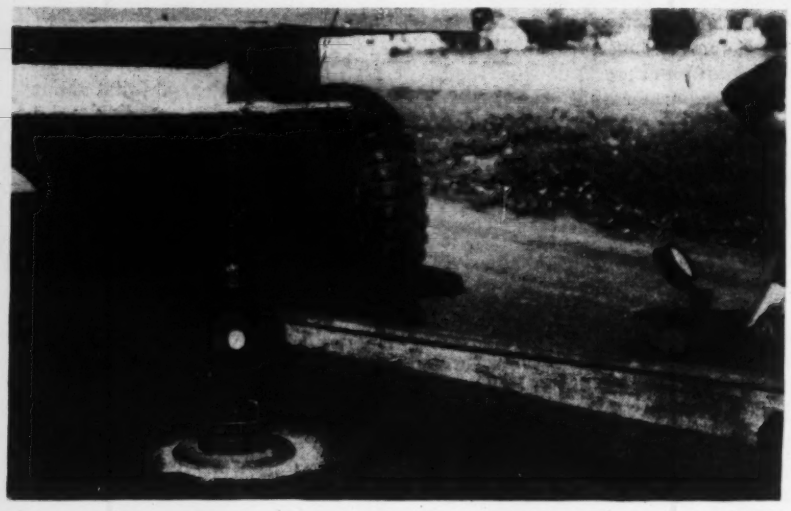
An indicator of the increasing importance of motor heavy truck transport was contained in a report issued recently by the American Road Builders' Association which said that about 50 percent more coal is now shipped by truck than before the war.

Referring to a study recently completed by the Department of Commerce on motor truck transportation, J. T. Callaway, president of the ARBA, said that some 50,000,000 tons of coal were hauled from mines to consumers last year.

"This study indicated that trucks handled 46 percent more bituminous coal in 1946 than they did in 1939 and the increase in anthracite tonnage hauled by truck during the same period was 59 percent," Mr. Callaway said. He added that the reason for the huge truck haulage was obvious—smaller cost, less handling and provision of pick-up and delivery service. Trucks move faster since they travel at an average speed of about 30 mph. as compared to 15.7 mph. for freight trains.

Considering the report from the standpoint of highway engineers and users, Mr. Callaway pointed out that the Commerce Department survey does not indicate two additional factors. "In the first place, strip mines move a larger tonnage of coal by truck than the shaft mines. One out of every six tons of coal shipped from all mines now go by truck. Secondly, local delivery service from coal yards to private and industrial consumers is not figured in the survey. Most of this delivery is by trucks and involves a tremendous amount of coal.

TRUCK AND TRAILER used in tests to determine the loss of load carrying capacity on Minnesota highways during spring thaws.



CLOSE-UP OF THE TESTING DEVICE when set up under the rear of the truck frame. Deflections are measured by the beam extending to the right.

Effect of Frost on Roads Studied in Minnesota

TESTS to determine the amount by which the safe bearing capacity of highway pavements is reduced during the period when frost is coming out of the ground are now being made by the Minnesota Department of Highways. The primary purpose of this study is to obtain specific information to support the highway department's policy of requiring a reduction in axle loads during the time when frost is leaving the ground each spring.

For many years Minnesota has followed the practice of requiring axle loads to be reduced from the legal limit of 9 tons to as low as 3 tons during the the spring to save the highways from serious damage due to loads in excess of what they could safely be expected to carry during the period when the subgrades may be softened by thawing. These restrictions affect only about 5 percent of the road users, but that 5 percent has been very articulate in its criticism of the restrictions. Hence the highway department is seeking scientific data to support restrictions that up to the present could only be based on estimates of what loads could be carried safely by the weakened pavements.

The equipment now being used to determine the amount by which the load bearing capacities of pavements and subgrades are reduced during spring thaws is shown in the accompanying illustrations. The truck and trailer are so arranged that loads up to 30,000 lb. can be applied to a 12-in. diam. bearing plate, which approximates the area of a large dual-tired truck wheel. Test loads up to 10,000 lb. can be applied without the use of the trailer.

Tests are made at points designated by the highway department's research laboratory and are repeated throughout the year except when the ground is frozen. The cycle of tests can either be started during the summer after the soils and granular bases have fully recovered from the effects of frost, or they can be started in the spring of the year as soon as frost starts leaving the ground.

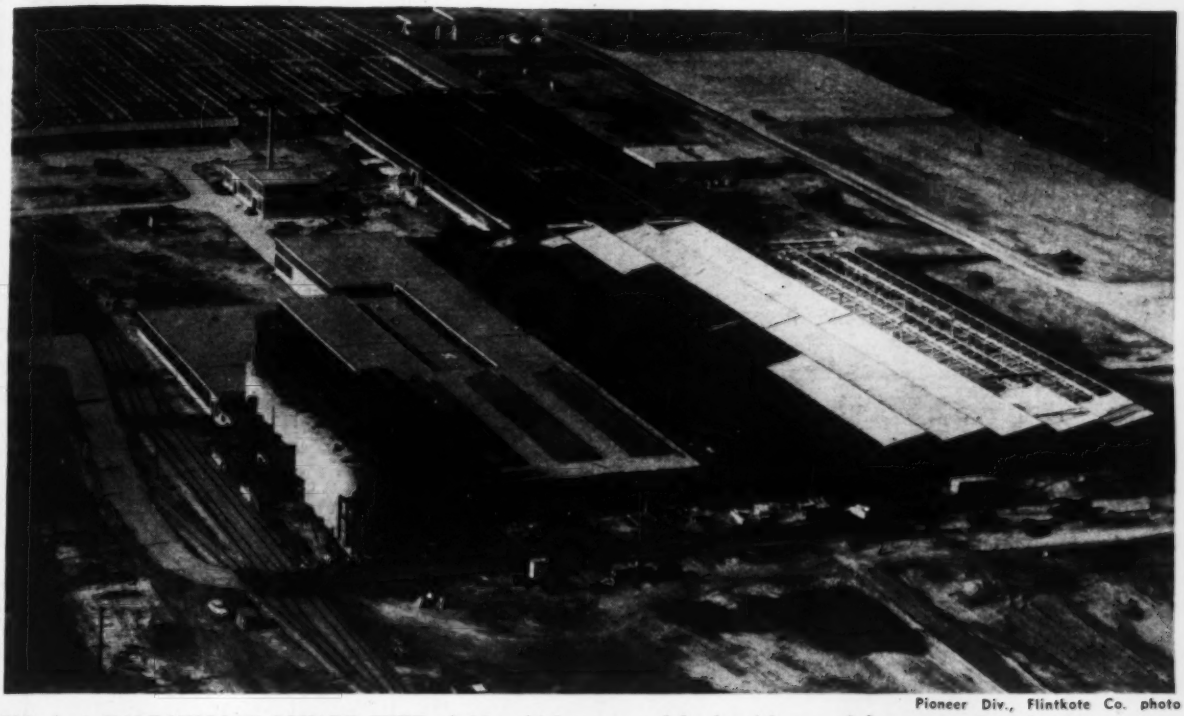
Highways selected for the tests have a variety of soils and bases so that the results will be representative of conditions found throughout the state.

Loads are applied at any designated point on top of the pavement, on the granular base, or on the subgrade soil. Only roads with blacktop surfacing are being tested.

The testing unit, being fully portable, can be moved readily from point to point. Loads are applied by means of a hydraulic jack, and deflections are measured by a deflection beam. The load is applied until a predetermined deflection is obtained, the load being repeated for each deflection and load readings taken before proceeding with the testing equipment to the next deflection.

Experience to date has shown that on practically all soils tested, the safe load bearing capacity is reached at a deflection of three-tenths of an inch in the black-top pavement. Results also indicate that when frost is coming out of the ground, most types of soil lose more than 50 percent of their load carrying capacity. This appears to apply equally to clay type soils as well as sand and gravel types.

The test program is being carried out under the direction of C. L. Motl, maintenance engineer, Minnesota Department of Highways.



Pioneer Div., Flintkote Co. photo

FIG. 1. A HALF-MILLION SQUARE FEET of 4-in. thick precast slabs furnish a roof for a porcelain factory.

Factory Roofed with Pumice-Concrete Units

A ROOF SLAB consisting of hollow units of lightweight concrete was recently installed on a new "pottery" plant built for the American Radiator & Standard Sanitary Corp. at Torrance, Calif. Unique methods were employed to place the 4-in. thick, precast slabs, most of which were 10 x 2½ ft. Other features of the plant include provisions for spot ventilation, floor slab placed by the vacuum method, and storage silos for raw materials.

The completed plant, with nearly a half million square feet of roof area, will be used in the manufacture of vitreous china lavatories, water closets and other porcelain plumbing fixtures. It is the largest of its kind west of Pittsburgh.

There are three primary sections in the main portion of the plant. The first, seen in the foreground in Fig. 1, consists of mixing and casting areas, most of which are under a saw-toothed type roof for better ventilation. Next is the kiln area, a long narrow section housing the baking kilns. This section has a pitched roof for better control of the heat developed by the kilns. The third section is a warehouse area that requires no special ventilation and has a flat roof with raised flat portions for better light.

Other buildings include a cafeteria for the 500 employees, a powerhouse, twenty 16-ft. dia. silos, and an office building. Space is available in the 1,100 x 1,300-ft. site for employee parking and for a recreation field.

Adapted from German plant

Extensive use of steel is objectionable in the roof of pottery plants, since small flecks of rust that drop from the steel will show up as red blots when the pottery is baked. For this reason, some plants in Germany before the war had concrete roofs of precast slabs similar to those in use at Torrance. B. H. Prack of Prack & Prack, architects on the Torrance work inspected these German plants prior to the war and planned to use such slabs at Torrance, provided cost and weight limitation factors could be met.

A Los Angeles firm specializing in such work (Wailes-Bageman, Inc.) submitted a design and bid that met the desired requirements. This firm did all the work in connection with the roof slab including casting and placing the precast units, spot welding the stud bolts, and placing the grout key, but not including placing the protective roofing material.

Various sizes of wire-reinforced, precast slabs were provided to fit the roof sections. However, most of the slabs were 4 in. thick, 10 ft. long and 2 ft. 5¼ in. wide (Fig. 2). Each of them weighs some 500 lb., or about 20 psf. Eight 2⅝-in. dia. holes extend the length of each unit. These holes are formed during pouring by inflated rubber tubes. An 8-hr. cure in a steam kiln is used.

Slabs are poured on steel plates so that the bottom, which forms the interior ceiling, is very smooth, and requires no plaster. The portions along the sides of the slab that butt

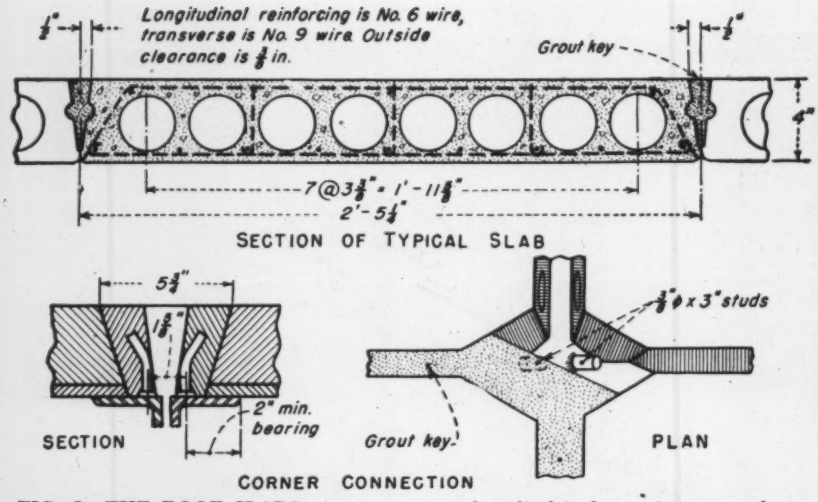


FIG. 2. THE ROOF SLABS were precast with cylindrical openings to reduce the weight. At the corners they were chamfered to provide for stud anchors welded to the building frame.

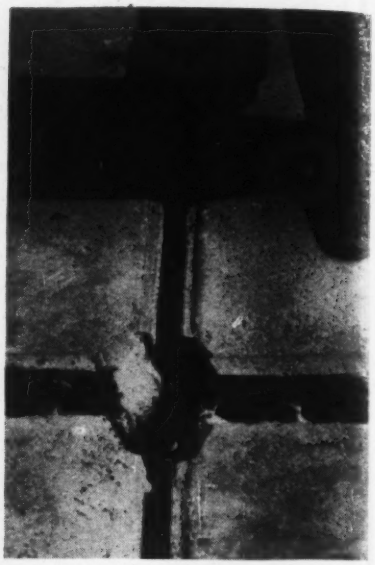


FIG. 3. THE CHAMFER at the slab corners provided an opening for lugs welded to the frame (see Fig. 2), which when filled with grout served as anchors.

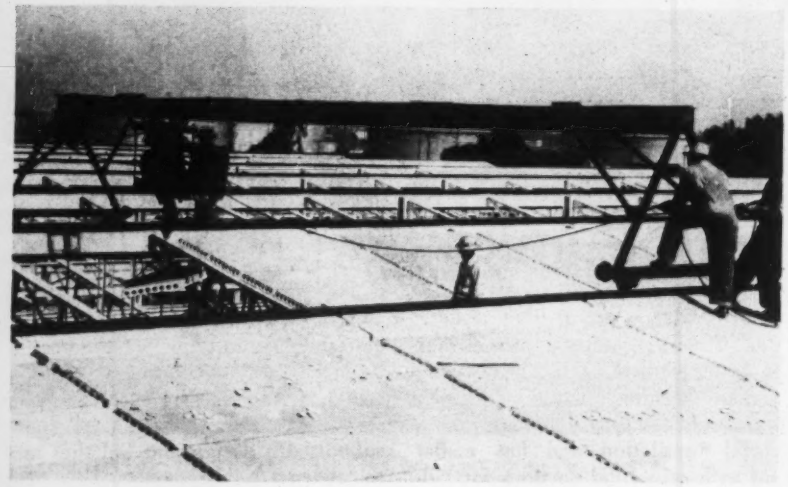


FIG. 4. BRIDGE CRANE of special construction rode the peaks of the saw-toothed section to place the hollow slabs.

against adjoining slabs are also smooth, but the remainder of these sides of the slabs is rough so that grout will hold better. Vacuum process is used in pouring the precast slabs, giving a texture to the top for better bond with the protective roofing material.

Volcanic pumice is used as the principal aggregate, resulting in a concrete weighing 97 lb. per cu. ft. The slabs are designed for live loads of 20 psf., but under actual test failure was not produced until a load of some 290 psf. was placed.

The slabs are held in place by means of a grout key poured along all four sides. Helping to form the key is an indentation along the sides that also makes handling easier. Disk bulkheads placed in each of the tubular openings keeps grout out of the hollow portions of the slabs.

A corner chamfer permits the placing of two ¾ x 3-in. studs by the arc stud welding process (Fig. 3). These aid in holding the slabs in place after the grout key is poured.

In designing for lateral forces imposed by earthquake loads, the roof slab was assumed to take some shear. The light weight of the roof slab also cut down the amount of the lateral forces imposed, since the forces are functions of the weight.

Three different methods were used in placing the slabs, depending upon the type of the roof. On the saw-toothed roof section, a bridge crane (Fig. 4) with a gas-engine hoist and 40-ft. span was used. Except for the hoist, the crane was operated by manpower.

On the kiln section where the pitch of the roof is irregular, a motor-driven crane with 120-ft. boom was used. This kiln building is 420 ft. long but only 160 ft. wide, so that a crane operating on the ground from the two sides of the building could service the entire roof area.

On the flat-roof section, slabs were hoisted to roof level eight at a time by fork-lift truck, with an extension to enable reaching the higher roof sections. Two-wheeled dollies with 6-ft. extensions were used to handle the slabs on the roof. A sling for picking up the slabs was attached at the end of the extension. Since each slab weighed some 500 lb., the dollies were counterweighted with a 450-lb. weight made movable to better keep balance.

All of this equipment enabled good progress to be made. As much as 9,000 sq. ft. of roof slab was placed in one 8-hr. working day.

All the concrete roof was covered with a protective roofing. On the saw-toothed roof section, subject to high interior temperature and humidity, the roofing consisted of four layers of 15-lb. asphalt felt, a smooth 70-lb.

cap sheet and a final protective coating. The lightweight concrete is porous enough to permit nailing roofing paper to it.

Floors finished with vacuum process

All of the floor slabs for this large plant were poured using the vacuum process. A wet mix was used for ease in placing, and excess water was drawn out by suction mats. Slabs were poured in a checkerboard sequence to minimize shrinkage cracks.

After the mats were removed, the floor was processed by means of power-driven float-finishers and later hand finished with steel trowels. This produced a hard, industrial-type finish; so hard in fact that some trouble was encountered in piercing the floor slab to place machinery.

Ventilation important

Because of the nature of the product handled, ventilation was given much attention. During the daytime, a temperature of 85 deg. F. and humidity of 80 percent is required on the casting floor, and night time requirements are greater. This is to protect against sudden drops in the outside temperature or humidity that could easily cause the damp clay pieces to crack. However, when a large number of pieces are being cast at one spot, the humidity in the vicinity is raised above the minimum required by the wet clay. Conditions then become very uncomfortable. For this reason, each saw tooth of the casting area roof is provided with a number of fans so that critical areas can be spot ventilated.

Some of the heat for the casting area is provided by the continuous kilns used for baking the porcelain product. These kilns are each 400 ft. long, this length being required because only a single firing is used in the Torrance process. The porcelain pieces move slowly through the kilns on cars and are subjected to a slow heat.

In some of the older-type pottery plants two heats are used, one to fire the "biscuit" and a later one to put the glaze on it. By using long kilns and slow heat this can all be done in one step at Torrance.

Raw material storage is provided by twenty 16-ft. dia. by 40-ft. high silos honeycombed together for mutual support. Each silo will contain a different grade of ground clay or sand for the porcelain work. Raw material is withdrawn by an automatic process from any one of four ports in the bottom of each kiln and transported by a conveyor system to the mixing floor.

This plant was built for the American Radiator & Standard Sanitary Corp., of Pittsburgh, Pa., H. M. Reed, Jr., vice-president and general manager of manufacturing. Architects were Prack & Prack, Pittsburgh, Pa. Structural design was done by Ellis Wing Taylor and S. B. Barnes, structural engineers, Los Angeles. The roof slabs were designed by C. D. Wailes, Jr., president of Wailes-Bageman, Inc., Los Angeles, who had the contract for installation of the roof and floor slabs. General contractors were Walle, Camplan Co. & Smith.

FIG. 5. COMPLETED SLAB on flat roof portion of the plant. Roofing felt was later nailed into the lightweight concrete.

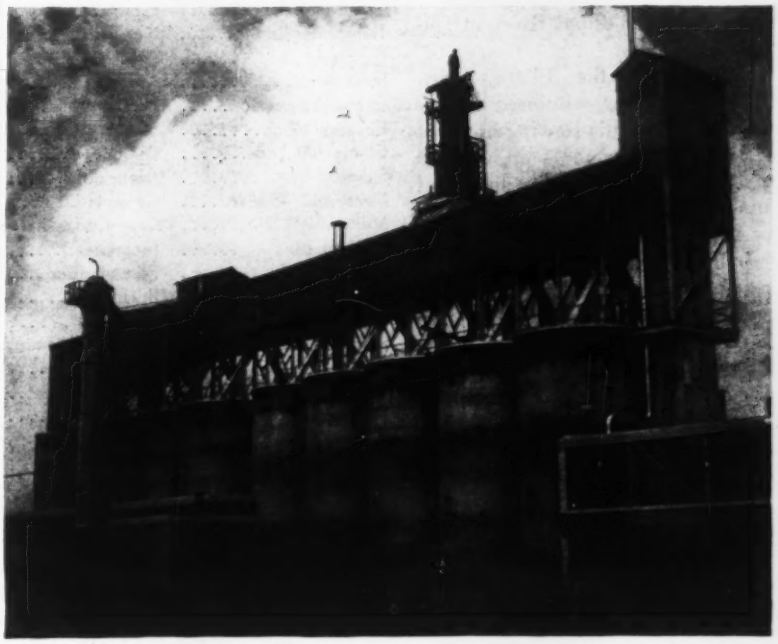


FIG. 6. CONCRETE SILOS were built to store raw materials used in manufacturing the vitreous china fixtures. The silos are equipped with automatic withdrawal facilities.

The World's Most Notable Bridges

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ANNOUNCEMENT that the Germans are building a girder span of 605 ft. at Cologne focuses attention on the fact that it has been five years since a record-setting bridge of any type was built anywhere in the world, and also five years since one was constructed in the U. S. In 1943, Sweden completed its Sando bridge whose span of 866 ft. sets a world record for concrete arches. The last record-breaking bridge in the United States was the continuous truss span of 845 ft. over the Mississippi River at Dubuque (1943).

Compared to the 1930's, when nearly every year witnessed a new bridge triumph, this slowing down of an accelerated tempo is an unusual situation, although there have, of course, been longer periods in history when bridge building, as measured by increasing span lengths, showed no progress. This is brought out by the tabulations on notable bridges that the author has developed over many years, and which are reproduced here in part. (The complete tabulations include many bridges of shorter spans than those listed.)

Progress in the bridge building art is, of course, not solely, nor even in major part, measured by increased span lengths. Improvements in design, economics, new materials, new types, and easier erection are other criteria of progress. But length of span is one of the measures by which bridges are judged, and it provides a concenient over-all index of related advances in the art.

The progress in long-span construction that has been arrested by the war and by post-war conditions may be expected to reappear with renewed impetus to satisfy the accumulated demand. There are many locations where long-span bridges are required and where new record-breaking spans will be built as soon as their financing becomes feasible.

Some bridge types, as indicated by the tabulations below, have apparently reached their economic limits of span length. For the cantilever, simple truss, bascule, swing span, and masonry arch, little or no increase in span length has been recorded in a generation or more.

On the other hand, new frontiers of unprecedented span lengths have been opened for the suspension type, also for plate girder spans, concrete girders and concrete arches. It is significant to note that, since the completion of the Quebec Bridge in 1917, the cantilever bridge has yielded its previously claimed supremacy to the suspension type. The world's five longest spans are suspension bridges. A generation ago, the feasibility of a span of 3000 feet was seriously questioned. Now bridge engineers confidently agree that suspension bridge spans up to 10,000 feet are practicable and may be expected.

THE WORLD'S LONGEST SPANS

Type	Bridge	Location	Date	Span
Cable Suspension	Golden Gate	San Francisco	1937	4200
Transporter Bridge	†Sky Ride	Chicago	1933	1850
Cantilever	*Quebec	Canada	1917	1800
Steel Arch	Kill Van Kull	New York City	1931	1652
Eyebar Suspension	*Florianopolis	Brazil	1926	1114
Concrete Arch	Sando	Sweden	1943	866
Continuous Truss	Dubuque	Mississippi R.	1943	845
Simple Truss	*Metropolis	Ohio River	1916	720
Continuous Girder	Cologne-Deutz	Rhine	1948	605
Vertical Lift	*Cape Cod Canal	Massachusetts	1935	544
Wichert Truss	Homestead	Pittsburgh	1937	533½
Swing Span	*Fort Madison	Mississippi R.	1927	525
Tubular Girder	*Britannia	Menai Straits	1850	460
Timber Span	†Wettingen	Switzerland	1758	390
Bascule	*Sault Ste. Marie	Michigan	1914	336
Masonry Arch	Plauen	Germany	1903	295
Single-Leaf Bascule	*Sixteenth Street	Chicago	1919	260
Concrete Girder	Villeneuve	France	1939	256

* Railroad bridge. † Not standing.

PROGRESS IN BRIDGE BUILDING

As Recorded in Successive Record Span Lengths

Year	Bridge	Location	Type	Span
219 B. C.	Martorell	Spain	Stone arch	121
14 A. D.	†Nera River	Lucca, Italy	Stone arch	142
104	†Trajan's	Danube River	Timber arch	170
1377	†Trezzo	Italy	Stone arch	251
1758	†Wettingen	Switzerland	Timber arch	390
1816	†Schuylkill Falls	Philadelphia	Suspension	408
1820	†Union (Tweed)	Berwick, Eng.	Chain	449
1826	Menai	Wales	Chain	579
1834	†Fribourg	Switzerland	Suspension	870
1849	Wheeling	Ohio River	Suspension	1010
1851	†Lewiston	Niagara River	Suspension	1043
1867	Cincinnati	Ohio River	Suspension	1057
1869	†Clifton	Niagara Falls	Suspension	1268
1883	Brooklyn	New York	Suspension	1595½
1889	Forth	Scotland	Cantilever	1700
1917	Quebec	Canada	Cantilever	1800
1929	Ambassador	Detroit	Suspension	1850
1931	George Washington	New York	Suspension	3500
1937	Golden Gate	San Francisco	Suspension	4200

† Not standing.

WORLD'S LONGEST BRIDGE SPAN is in San Francisco's Golden Gate crossing, 4,200 ft. between supports.

Notable Bridges by Types and in Order of Span Lengths

* Railroad Bridge. † Not Standing. ‡ Fixed ends.

SUSPENSION

Year	Bridge	Location	Span
1937	Golden Gate	San Francisco	4200
1931	George Washington	New York City	3500
1940	†Narrows	Tacoma, Wash.	2800
1936	Transbay	San Francisco	2310
1939	Bronx-Whitestone	New York City	2300
1929	Ambassador	Detroit	1850
1933	†Sky Ride	Chicago	1850
1926	Delaware River	Philadelphia	1750
1924	Bear Mountain	Hudson River	1632
1903	Williamsburg	New York City	1600
1883	Brooklyn	New York City	1595½
1939	Lions Gate	Vancouver, B. C.	1550
1930	Mid-Hudson	Poughkeepsie, N. Y.	1500
1909	Manhattan	New York City	1470
1936	Triborough	New York City	1380
1869	†Clifton	Niagara Falls	1268
1941	†Rodenkirchen	Germany	1244
1931	St. Johns	Portland, Ore.	1207
1929	Mount Hope	Rhode Island	1200
1926	*Florianopolis	Brazil	1114
1939	Deer Isle	Maine	1080
1931	Maysville	Ohio River	1060
1935	Ile d'Orleans	Quebec	1059
1867	Cincinnati	Ohio River	1057
1939	Beit (Zambezi)	S. Rhodesia	1050
1851	†Lewiston	Niagara River	1043
1929	†Cologne-Mulheim	Germany	1034
1900	Miampimi	Mexico	1030
1849	Wheeling	Ohio River	1010

CANTILEVER

1917	*Quebec	Canada	1800
1889	*Forth	Scotland	1700
1943	Howrah	India	1500
1936	Transbay	San Francisco	1400
1930	Longview	Columbia River	1200
1909	Queensboro	New York City	1182
1927	Carquinez Strait	California	1100
1930	*Harbor Bridge	Montreal	1097
1929	Cooper River	Charleston, S. C.	1050
1940	Story Bridge	Australia	924
1940	Natchez	Mississippi R.	875
1938	Bluewater	Port Huron, Mich.	871
1940	*Baton Rouge	Mississippi R.	848
1899	*Cornwall	St. Lawrence R.	843
1939	Brownville, Neb.	Missouri R.	840
1940	Greenville	Mississippi R.	840
1930	*Vicksburg	Mississippi R.	825
1929	Louisville	Ohio River	820
1890	Landsdowne	Sukkur, India	820
1935	†Krefeld-Uerdingen	Rhine R., Germany	820
1904	*Monongahela	Pittsburgh	812
1935	Rip Van Winkle	Catskill, N. Y.	800
1932	Lake Union	Seattle	800
1938	Cairo, Ill.	Ohio River	800
1940	Ludlow Ferry	Potomac River	800

STEEL ARCH

1931	Kill Van Kull	New York City	1652
1932	*Sydney Harbour	Australia	1650
1935	Birchenough	S. Rhodesia	1080
1917	*Hell Gate	New York City	977‡
1941	‡Rainbow	Niagara Falls	950
1898	†Clifton	Niagara Falls	840
1936	‡Henry Hudson	New York City	800
1939	Waal River	Nijmegen, Holland	790
1931	West End	Pittsburgh	778
1931	Croton Lake	Westchester, N. Y.	750
1931	McKees Rocks	Pittsburgh	750
1898	*Viaur Viaduct	France	722
1936	West Bridge	Stockholm	668
1907	*Victoria Falls	Rhodesia	650
1924	*Michigan Central	Niagara Falls	640
1912	‡Vilaine	France	627
1928	Lee's Ferry	Colorado River	616
1898	†Bonn	Germany	614
1938	Middletown	Connecticut	600
1936	Yaquina Bay	Oregon	600

CONCRETE ARCH

Year	Bridge	Location	Span
1943	Sando	Sweden	866
1940	*Esla	Spain	645
1929	Plougastel	Brest, France	612
1934	Traneberg	Stockholm	594
1937	La Roche-Guyon	France	528
1946	Svinesund	Sweden	509
1942	Podolsko	Czechoslovakia	498
1940	Bern	Switzerland	492
1933	Castelmoron	France	470
1931	Westinghouse	Pittsburgh	425
1938	Teufelstal	Jena, Germany	452
1928	Caille (plain conc.)	Annecy, France	450
1937	Kraezern	Switzerland	440
1923	St. Pierre-du-Vauvray	France	432
1946	Fuerstenland	Switzerland	430
1939	Faerjsund	Finland	427
1929	Eschelbach	Germany	426
1930	Conflans	France	414
1923	Cappelen	Minneapolis	400
1935	Tarendo	Kalix R., Sweden	400
1930	Jack's Run	Pittsburgh	400

CONTINUOUS TRUSS

1943	Dubuque, Ia.	Mississippi R.	845
1935	†Duisburg	Germany	839
1944	St. Louis	Mississippi R.	804
1917	*Sciotoville	Ohio River	775
1929	Chain of Rocks	Mississippi R.	699
1935	†Neuwied	Germany	698
1929	*Cincinnati	Ohio River	675
1928	Cape Girardeau	Mississippi R.	672
1946	Chester, Ill.	Mississippi R.	670
1930	Quincy, Ill.	Mississippi R.	628
1934	Bourne	Cape Cod Canal	616
1935	Sagamore	Cape Cod Canal	616
1936	†Maxau	Germany	575
1936	Meredosia	Illinois	567
1936	Hannibal, Mo.	Mississippi R.	562½
1927	Ross Island	Portland, Ore.	535
1937	Homestead (wichert)	Pittsburgh	533½
1935	South Omaha	Missouri River	525

SIMPLE TRUSS

1917	*Metropolis	Ohio River	720
1929	Paducah, Ky.	Ohio River	716
1922	Tanana River	Alaska	700
1911	*MacArthur	St. Louis	668
1933	*Henderson	Ohio River	665
1919	Louisville	Ohio River	644
1917	*Quebec	Canada	640
1912	*Homberg	Germany	610
1933	Atchafalaya	Morgan City, La.	608
1924	*Castleton	Hudson River	598½
1906	Elizabethtown	Great Miami R.	586
1929	*Louisville	Ohio River	546½
1889	*Cincinnati	Ohio River	542½
1896	*Philadelphia	Delaware River	533
1931	*Belgrade	Danube	532
1914	Pittsburgh	Allegheny River	531
1930	*Martinez	California	525

PLATE GIRDER

1948	Cologne-Deutz	Germany	605
1939	†Frankenthal	Cologne, Germany	528
1940	Dirschau	Weichsel River	467
1850	*Britannia (tubular)	Menai Straits, Wales	460
1848	Conway	Wales	400
1938	Berlin-Halle	Germany	38[illegible]
1938	Ingolstadt	Danube River	37[illegible]
1930	Dresden	Germany	378
1935	†Mangfall	Germany	354
1934	Trois Roses	Basel, Switzerland	345
1936	Harburg	Germany	335
1859	*†Victoria (tubular)	Montreal	330
1937	Ostoder, R.	Stettin, Germany	325
1937	Stettin	Germany	300
1942	Charter Oak	Hartford, Conn.	300
1926	†Friedrich Ebert	Mannheim, Germany	282
1937	Westoder R.	Stettin, Germany	276
1940	Lakefront	Cleveland, Ohio	271
1936	Muldetal	Germany	268
1855	Bryne	England	267
1940	Thos. A. Edison	Perth Amboy, N. J.	250

VERTICAL LIFT

1935	*Cape Cod Canal	Massachusetts	544
1937	Marine Parkway	New York City	540
1931	Burlington, N. J.	Delaware River	534
1912	*Fratt	Kansas City	425
1945	Harry S. Truman	Kansas City	420
1932	*M-K-T R. R.	Missouri River	408
1930	Duluth	Minnesota	386
1941	St. Johns River	Jacksonville, Fla.	386
1922	*Cincinnati	Ohio River	365
1933	Albany-Rensselaer	Hudson River	341
1933	Troy-Menands	Hudson River	341
1941	Passaic River	New Jersey	332½
1930	*Martinez	California	328
1927	Cochrane	Mobile, Ala.	325
1929	*Pennsylvania-Lehigh	Newark Bay	322
1920	*Tennessee River	Chattanooga, Tenn.	310
1936	Triborough	New York City	310
1936	Hardin	Illinois River	309
1928	James River	Newport News, Va.	300
1929	San Mateo	California	300
1926	*Missouri Pacific	Kragen, Ark.	300
1924	Piscataqua River	Portsmouth, N. H.	300

SWING SPAN

1927	*Fort Madison	Mississippi R.	525
1908	*Willamette R.	Portland, Ore.	521
1893	†*East Omaha	Missouri River	520
1903	*East Omaha	Missouri River	519
1889	†*Thames River	New London, Conn.	497½
1888	*Arthur Kill	New York City	496½
1897	*Duluth, Minn.	St. Louis Bay	486
1899	*C. M. & N. R. R.	Chicago	474
1895	*Sioux City, Ia.	Missouri River	470
1878	†*Raritan Bay	Perth Amboy, N. J.	469
1914	*Coos Bay	Oregon	458
1905	*Tennessee R.	Gilbertsville, Ky.	450
1896	†Middletown	Connecticut	450

BASCULE

1914	*Sault Ste. Marie	Michigan	336
1940	Erie Avenue	Lorain, Ohio	333
1917	Chattanooga	Tennessee River	310
1913	Broadway	Portland, Ore.	278
1901	*Terminal Ry.	Chicago	275
1921	Wells Street	Chicago	268
1937	Outer Drive	Chicago	264
1919	*Sixteenth Street	Chicago	260
1929	Tacony-Palmyra	Delaware River	260
1920	Michigan Boulevard	Chicago	256

Pre-Bidding Conference Speeds Chain-of-Rocks Canal Work

As ONE MEANS of reducing construction costs and insuring maximum competition, the Corps of Engineers is continuing its practice of holding conferences with interested general contractors prior to the preparation of final plans and specifications for major construction projects. One of these pre-bidding conferences was held Aug. 24 and 25 in the office of Col. R. E. Smyser, Jr., St. Louis District Engineer, where 38 representatives of 20 contracting firms met to discuss construction of the proposed Chain of Rocks Canal on the Illinois side of the Mississippi near St. Louis.

The Chain of Rocks Improvement —authorized by the River and Harbor Act of March 2, 1945—will bypass the troublesome Chain of Rocks reach in the Mississippi by providing a channel of dependable 9-ft. depth. The complete plan involves construction of an 8-mi. canal, bordered by levees, with two parallel navigation locks near the lower end.

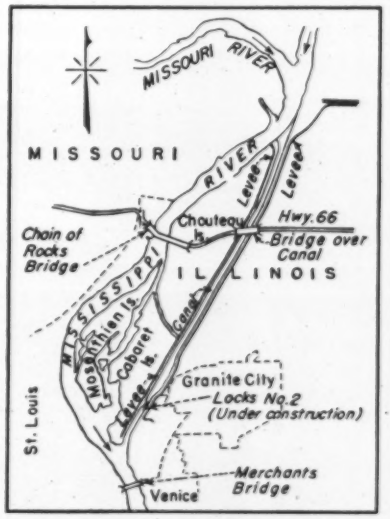
Construction of a 1,200x110-ft. main lock and 600 x 110-ft. auxiliary is now underway by River Construction Corp. (a combination of eight large contracting firms) under a $16,000,000 contract, with completion forecast for October, 1950. Foundation excavation is now substantially complete, and the first of an estimated 400,000 cu. yd. of concrete has recently been poured.

Canal design

Tentative design of the canal calls for a 300-ft. bottom width with 1 on 3 sideslopes. Depth of canal cut below existing ground ranges from 15 to 43 ft., with a 35-ft. average. Major item of work is excavation of 23,000,000 cu. yd. of material—mostly fine sand—including stripping and later replacement on embankments of 1,800,000 cu. yd. of topsoil. Excavated material will be used to form protective levees parallel and adjacent to the canal, and these will have a 20-ft. crown width, 1 on 5 sideslopes, and wide berms. Levee height varies from 20 to 29 ft., with net grade 61½ ft. above the bottom of the canal cut.

To explain these canal features, Colonel Smyser opened the conference with a general orientation meeting, followed by an inspection trip to the canal site. The river side of the project was viewed from the Army Engineers' 1,000-hp. diesel towboat Del Commune (named for Charles Del Commune who was senior engineer in charge of open river regulating works on the Mississippi and who did much to foster dike and revetment improvements). The trip through the swift current and tortuous channel of the Chain of Rocks reach provided a dramatic demonstration that elimination of this troublesome stretch of river by canalization is badly needed.

Land inspection of the canal route followed the river trip. An excellent idea of the type of material expected to be encountered during canal excavation was obtained at the locks project where the contractor has gone down to limestone bedrock 32 ft. below canal bottom grade, and at a pipeline relocation job now underway to bury oil lines below the canal bottom. Perhaps the best view of the general topography of the area was obtained from the deck of a $1,500,000 high-level bridge now nearing completion to re-route U. S. Highway 66 over the proposed canal.



DANGEROUS RIVER REACH, with average fall of 1½ ft. per mile, currents up to 12 fps. and only 5½-ft. depth at extreme low water, will be bypassed by a new canal.

Construction schedule

On the next day, a summary discussion of the canal and its problems brought out the fact that the government has only $1,000,000 for payment to the contractor during this fiscal year. Unofficial estimates on canal cost run as high as $12,000,000, and planning is being made on the assumption that additional funds will be forthcoming from Congress during the next two fiscal years to permit completion of the job. It is hoped that work on the canal may be started with available funds as soon as weather conditions permit next spring.

Although the majority of the guests present were representatives of dredging firms and felt that hydraulic methods would be most feasible for canal excavation, at least one contractor proposed a combination of land and water equipment. It was conceded that although the job could be completed in 700 calendar days, the 900 days proposed by the Army Engineers might bring increased competition from other methods requiring less investment in equipment.

In discussing the type of contract best suited for the project, few companies expressed willingness to bid the entire job on a continuing payment basis in view of the limited amount of money currently assigned to the canal. The general consensus of the dredge men was that 50 to 60 percent of the total funds should be on hand before the main excavation was started.

One type of continuing contract

proposed would allow the contractor to proceed with clearing, grubbing and topsoil stripping, but would not require him to move his large excavating equipment onto the job until a specified percentage of total required funds had been assigned. It was believed that this would enable the contractor to proceed early next year with preliminary work so that he could start canal excavation on July 1, when, it is hoped, Congress will have appropriated more money for the project. It was brought out that advance knowledge of funds available was necessary in order to figure the plant requirements of the job. Lack of such information would increase the cost of the work by raising the risk factor in the contractor's bid.

One proposed alternate to the letting of the canal job as a whole or in two halves (it was generally agreed that division into smaller reaches would be impracticable) was to use the currently available million dollars for a clearing, grubbing and stripping contract. Under this scheme, topsoil would be stored in protective levees along the canal route, so the successful bidder on the main canal could proceed immediately with excavation when that contract was subsequently let. For protection of the prime contractor in this case, it was felt that some provisions should be made to relieve him of responsibility of failure of green levees built by the stripping contractor.

Bank Slopes

On the question of sloping the canal banks, dredging contractors felt that the government could save money by relaxing its proposed 1 on 3 requirements. It was thought that above water the banks should be allowed to take their natural slope. Subaqueous slopes could be built more economically by stepping them down, or by widening the canal bottom and leaving unfinished slopes to slough off into the enlarged section.

In discussing bid items, it was agreed that canal excavation and embankment should be covered in the same item. However, most contractors favored separate payment for overhaul, with an estimated quantity included in the contract, to eliminate bid guesswork and consequent higher costs.

At the conclusion of the meeting, contractors expressed high approval of the Corps' aims in holding pre-bidding conferences, and felt they were mutually valuable both to the construction companies and to the government. It was recalled that in March, 1947, Col. Smyser held a similar meeting to discuss the Chain of Rocks locks project (*ENR*, April 10, 1947, Vol. p. 550), and that many worthwhile suggestions were received. Contractors who visited the locks site during the first conference did so during a sleet storm in freezing weather.

On the latest canal inspection trip the sun shone brightly and the thermometer hovered at 100. For those who made both trips, the weather averaged out quite satisfactorily.

Laboratory Control of Ocean Waves

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PRODUCTION of true wave form velocity, and particle movement for studying beach erosion and breakwater design has been accomplished with a new, plate-type machine at the University of Washington, Seattle.

Although the wave energy that must be dissipated by breakwaters may originate in several ways, prime consideration in breakwater design is given to pressures arising from waves due to wind action. Uniformity of these waves has brought about present-day theories of wave properties. Duplicating these properties mechanically is most easily accomplished by application of the trochoidal theory.

In deep water, (where the depth of water is greater than half the wave length) the water particles trace a circular path in a vertical plane. According to the theories advanced by various authorities, the deep-water wave form is trochoidal. A rolling circle of radius R generates the wave form which corresponds to successive positions of points P at any depth d. The wave length L is the distance from crest to crest, $2\pi R$; and the wave form moves with a velocity V equal to $2\pi R/T$, where T is the time required for one revolution of a water particle or of the generating circle, or the time required for two successive crests to pass the position of the observer. At the surface, the orbit radius r_s of the water particle P_s is one-half the wave height H. The crest of the wave is steeper and narrower than the trough, with the result that the orbit centers of the particles are above their still-water positions by a distance of y.

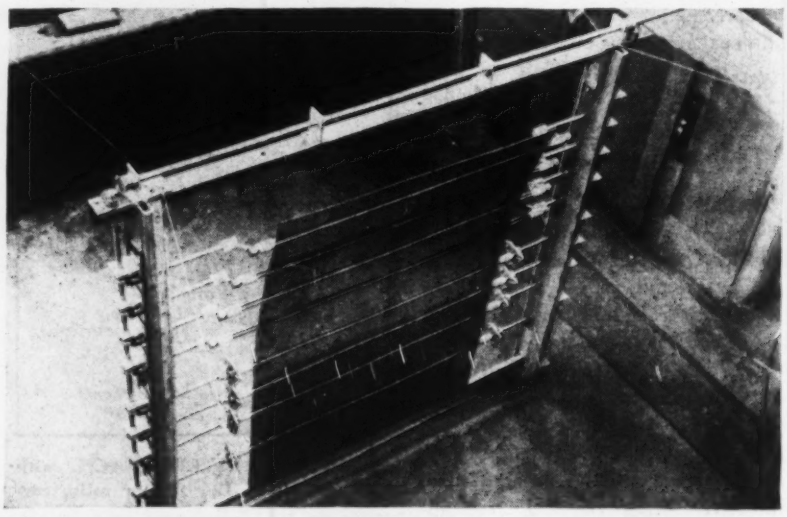

FIG. 1—PLATE-TYPE MACHINE that is used in the wave tank to generate accurate wave forms.

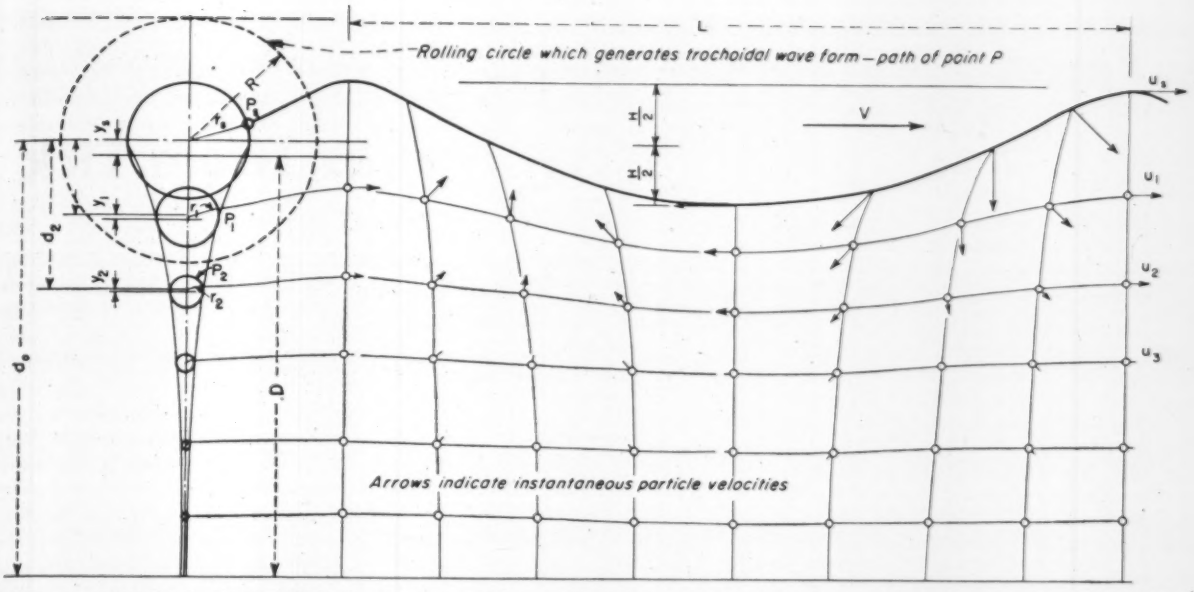

FIG. 2—WAVE ACTION FORM that is accurately reproduced in a test tank by the mechanical device shown in Fig. 1 for use in studying the effect of waves on beaches and breakwaters.

The properties of a deep-water wave (*Water Waves*, D. D. Gaillard), have the following relationships:

The velocity of propagation of the wave, V:

$$V = \sqrt{gR} \qquad (1)$$

The orbit radius at depth d, r:

$$r = r_s E^{-\frac{d}{R}} \qquad (2)$$

The constant tangential velocity of the particle, u:

$$u = \frac{rV}{R} \qquad (3)$$

New plate-type wave machine

The new wave machine applies this theory of wave action in producing controlled waves of true trochoidal form. It imparts the desired amounts of energy to the water at various depths through a flexible plate actuated by rods attached to rotating arms of adjustable radius. Position of the plate throughout the wave period is indicated by successive positions of any one particle at its respective depth. Since the orbit radius of the surface particle is one-half the wave height, the height is controlled by varying the length of the surface arm and setting the lower arms by Eq. (2). When the value of V given in Eq. (1) is substituted in Eq. (3), since u is proportional to rpm and R is proportional to wave length, the wave length varies inversely as the square of the revolutions per minute. Thus the wave length is controlled.

Lever arms actuate the plate

Four feet wide and five feet high, the plate covers the entire cross section of the channel in which it is to be used. Eight adjustable arms on either side, placed 6 and 9 in. apart, furnish the orbital particle movement, the upper four arms being telescopic and the four lower consisting of slotted plates. The variable y_s is set by adjusting the still-water depth below the center of the surface arm.

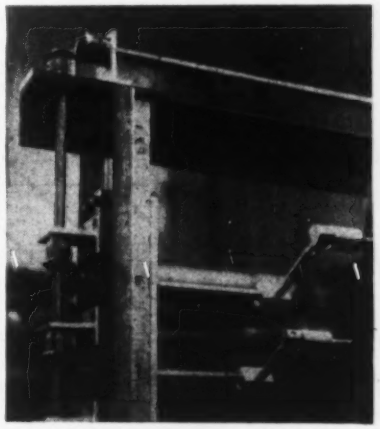

FIG. 3—CLOSE-UP of the adjustable arms that produce the orbital particle movement.

The back-and-forth particle motion at the bottom is produced by cams with a quarter-inch throw.

Governing factors in producing the maximum wave height and length are the $\frac{L}{H}$ ratio, which must exceed 7, and the depth of water, which cannot be less than $\frac{L}{2}$. Thus the maximum wave height is 1 ft., and the maximum wave length is 10 ft. for the designed depth of 5 ft.

The machine will be used at the University of Washington for experiments in breakwater design and beach erosion. An existing 170-ft. tank, 4 ft. wide and 4 ft. deep, will use a sloping bottom to convert the deep-water wave for studies in shallow-water wave action.

To prevent wave reflection, two 5-ft. long platforms extend horizontally across the channel at either end, the ones nearest the machine at a depth of 12 in., the other 9 in. Six-inch test cylinders from the concrete laboratory are placed vertically in a checker-board pattern, the spacing starting at 12 in. and diminishing to 4 in. at the end of the channel.

Prof. R. G. Hennes, University of Washington, conceived the idea for the machine, and Prof. F. B. Farquharson aided in its construction.

Flood Forecast Centers—
What Makes Them Tick

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Supervisory River Forecaster
Marshall M. Richards,
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THE COMPLEX PROBLEM of coordinating the U. S. Weather Bureau's river forecasting and flood warning service in the large river basins of the country is being successfully met by concentrating a large part of the forecasting work into new technical units, professionally staffed, called River Forecast Centers. The one at Cincinnati is typical. Its jurisdiction covers an area of 136,840 square miles of the Ohio Basin from below Wheeling, W. Va., to below the mouth of the Cumberland River, including 689 river miles of the Ohio, together with all tributaries entering the Ohio between these points. Within this area it has taken over the forecast responsibility that had for many years rested in eight Weather Bureau river districts, which continue to collect the river and rainfall reports, but now base their forecasts and warnings on master forecasts from the river forecast center.

Forecasting technique

The initial step in the preparation of forecasting procedures for headwater areas was the development of a relation for predicting the amount of runoff that may be expected from a given storm. Prevailing moisture conditions, it was found, could be adequately expressed in terms of the time of year and an index of antecedent precipitation. These factors, along with the amount of precipitation in the storm and its duration, are used to predict the quantity of storm runoff. The antecedent precipitation index used is derived by weighing the rainfall which occurred prior to the storm of interest according to the elapsed time. That is, rain occurring one day prior is assigned a much higher weight than that which fell several weeks previous.

The development of the runoff relations (Fig. 1) was accomplished through graphical correlation of numerous sets of data for past storms, as many as fifty or more being analyzed for each headwater basin. The rainfall-runoff relation provides the necessary beginning for each forecast. The second step is to distribute the runoff with time according to the observed characteristics of each individual basin. This is accomplished by the application of the unit hydrograph principle ("Streamflow from Rainfall by the Unit Graph Method", by L. K. Sherman *Engineering News-Record*, p. 501, 1932.) to each of the headwater areas as well as to each of the ungaged local areas in the downstream reaches.

Once the flows from each sub-area of the basin are predicted, the final job of the forecaster is to combine these flows successively into forecasts for all points downstream. Various methods of flood routing are utilized, with preference being given to the simplest and fastest schemes that can be made to produce sufficiently accurate results. In many upstream tributary reaches the outflow is assumed to conform to a moving average or weighted moving average of the inflow graph, with satisfactory coefficients being determined through trial and error. This type of routing merely indicates that a certain per-

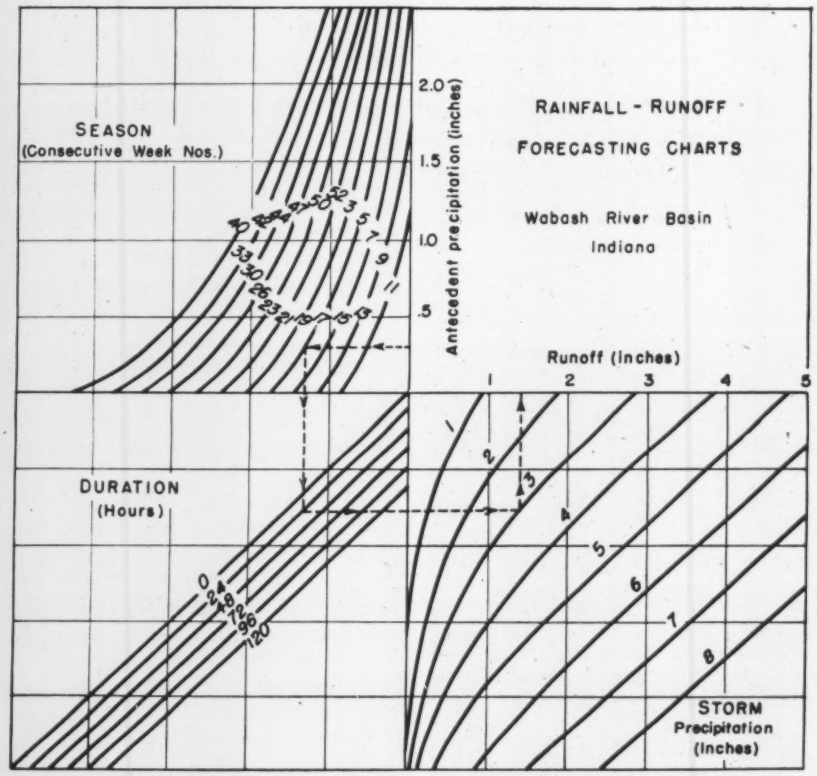


FIG. 1. RAINFALL-RUNOFF FORECASTING CHART for the headwaters of the Wabash River is typical of those developed for each basin. Sequence of procedure indicated by the dotted lines represents the first step in any forecast.

centage of the water at a given upstream point will reach the downstream station in successive periods of 12 hr., 36 hr., etc., with the total percentage adding up to 100.

In some cases the Meyer method is found advantageous (See "Simplified Flood Routing," *Civil Engineering*, p. 306, 1941), but for a majority of reaches on the larger rivers, the forecasting relations are developed by graphical correlation ("The Use of Crest Stage Relations in Forecasting the Rise and Fall of the Flood Hydrograph by M. A. Kohler, U. S. Weather Bureau, August 1944, mimeo.)

In the graphical technique either discharge or stage data may be used, with two inflow values and one outflow value being correlated with the final outflow value. The relation for the Ohio River reach from Maysville, Ky., to Cincinnati, Ohio, is shown in Fig. 2. The flow of the Little Miami and Licking Rivers is routed by successive averages, and the ungaged local area discharge forecast by means of a unit hydrograph. The sum of these discharges is then added to the "routed stage" from Maysville to determine the final forecast stage for Cincinnati, using the chart of Fig. 3.

Collecting the data

Equally important as the development of forecasting techniques is a smooth and efficient system for collecting current rainfall and river stage reports. A study of the forecasting relations showed that reports were necessary from 160 river gaging stations and nearly 300 precipitation stations if the forecasters were to have adequate data. This represents an average of one precipitation station for approximately 450 square miles of area.

In general, whenever 0.40 in. or more of precipitation occurs, the rainfall observers report each 6 hr. to designated collection centers by telegraph or by telephone. The 58 regular Weather Bureau offices in this area report directly on the nationwide weather teletype circuits at 1 or 6 hr. intervals. Key river stations report by telegraph or telephone daily while the balance of the river stations report whenever a definite predetermined critical stage has been reached, and thereafter daily or at 6 hr. intervals while the river is in flood at that

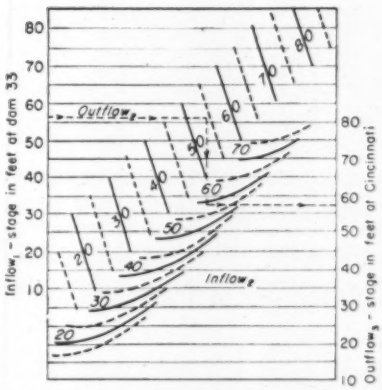


FIG. 2. STAGE RELATION CHART for routing of the Ohio River from Dam 33, Maysville, Ky., to Cincinnati. A typical routing is shown by the dotted lines.

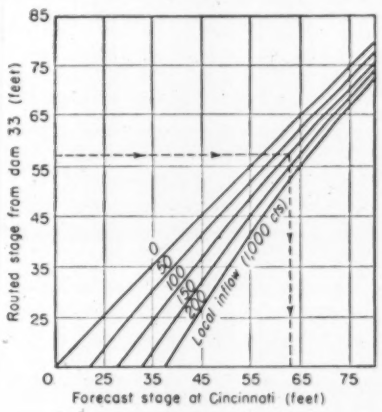


FIG. 3. RATING CURVES for adding tributary and ungaged local inflow to the routed river stage at Cincinnati as determined from Fig. 2.

point. During low water many river reports are sent in by mail daily so that the forecast center may keep a check on the initial starting point of flash flood rises. The collection centers relay all reports to the forecast center by TWX, which provides both rapid transmission and a written copy of the data.

Fast office procedure

Because forecasts must be released at the earliest possible moment if they are to have maximum value, the third important phase of forecast center planning involves the establishment of streamlined office procedure. Runoff quantities covering a wide range of values and their distribution in accordance with the respective unit hydrographs have all been pre-computed and tabulated ready for instant use. Also, before any current data are received, worksheets are dated, necessary data from previous forecasts transcribed, and all preliminary computations, such as determination of the antecedent precipitation index, completed. Thus, at forecast time, all possible preliminary operations have been cleared away.

As a further assurance of prompt and accurate forecasts, all visitors are excluded from the forecast center during flood periods, and no releases are made to the public through the center. All forecasts are transmitted to the river district offices for release as rapidly as possible, usually within two to three hours from the time of the observations on which the forecasts are based.

Forecasting experience in 1948

The 1948 flood season started early, and by April several periods of rising water had occurred to test the center's facilities. In each case the forecasting schemes worked, and the forecasts issued were timely and accurate. It was not, however, until the April, 1948 flood that the new forecasting service received its major test.

As the flood season neared its usual end early in April, all tributaries and the main Ohio River were receding, when a deluge of rain began on Sunday, April 11, and continued intermittently until Wednesday, April 14, yielding as much as 6.45 in. of rain at Creston, W. Va., a station on the Little Kanawha River. Many other stations had well over 5 in. during the series of storms that produced the highest flood that has been known to occur in the Ohio River so late in the season. It was the seventh largest flood in the 90 years of record at Cincinnati, and exceeded flood stage by more than 5 ft. everywhere from Pittsburgh to Cairo and as much as 14 ft. at Portsmouth, Ohio, with heavy damage along the entire course of the river. Most of the tributaries were also in flood with new record stages reported from Falmouth and Cynthiana, Ky., on the Licking River. The Ohio River rose 17 ft. in 24 hr. at Parkersburg, W. Va., and nearly 20 ft. in 24 hr. at Dam 22 near Ravenswood, W. Va., from the morning of the 12th to the 13th.

The reporting networks, communi-

cation schedules, forecasting procedures, and warning service stood up very well under the pounding of rain, flood waters, public and private demands for information, and the pressure of deadlines for forecasts. It takes nerve and faith in the computations to forecast record-breaking stages, but that was done in this flood for Falmouth, Ky., where the crest forecast of 42 to 43 ft. was issued 24 hr. in advance of the crest. The stage actually reached was 41.8 ft., while the previous highest stage of record was 41.4 ft. (January, 1937).

At Cincinnati the people have battled floods for years, but in April, 1948 some operations were very matter-of-fact. Several large produce commission houses have operating plants located in the low-rent flood zone of downtown Cincinnati, which begins to flood at stages ranging from 56 to 57 ft. Official flood stage is 52 ft. On Tuesday morning, April 13, with the river stage at 49.9 ft., and more rain expected, the forecast for Cincinnati called for 56 ft. by Wednesday morning and 59 ft. by Wednesday evening, and no crest yet in sight because of impending rain. Accordingly, all produce dealers began making plans to move out of the flood zone. Without panic they loaded their entire stock into trucks and sold it to retail dealers in the area at regular profits. One firm alone was known to have disposed of $75,000 worth of produce.

Flood forecast accurately

On Wednesday morning, with most of the rain fallen and reported, and with the river at 55.1 ft., the forecasts for Cincinnati called for 59.5 ft. Thursday morning, and a 64-ft. crest Saturday afternoon, 3½ days hence. Dealers finished loading produce and began moving equipment out of their warehouses. The flooding followed the schedule so closely that on Thursday morning the gage read 59.6 ft., only 0.1 ft. higher than forecast. On Friday morning it became apparent that the crest forecast would have to be revised upward about one foot due to rain that had occurred since issuing the last crest forecast. Accordingly, a revised crest prediction of 65 ft. was made Friday morning to occur late Saturday. Actual crest was 64.8 Sunday morning, April 18.

A flood is not over until the waters recede far enough to permit cleaning up and moving back. On Saturday morning, April 17, with the river cresting slowly and no important rain in prospect for several days, the recession forecast was issued calling for the Ohio River to fall below flood stage of 52 ft. at Cincinnati on Thursday afternoon, 5 days hence. The falling conditions again followed the forecasts very closely as the river fell to flood stage at 10 p.m. Thursday evening.

A complete and similar series of forecasts was furnished to the river district offices of the Weather Bureau for all points along the river course and their immediate and widespread dissemination helped many thousands of anxious flood victims to save themselves and as much of their property as possible. In one of the newspapers after this flashy and severe flood was over, the general statement was made that "Flood damage was less than usual."

The improved forecasting and flood warning service played its part in helping to reduce the losses this year which in the past have averaged $32,000,000 annually in the Ohio River valley.

Emergency Underpinning Keeps Old Building in Service

EXTREME SCARCITY of office space in San Francisco brought about the repair of a building foundation for the express purpose of keeping an old structure in service that otherwise would have been abandoned and torn down.

Although the repair methods were expensive, the emergency justified the cost since banking work could be continued by a clerical force occupying 25,000 sq. ft. of office space strategically located in the financial district: space for which no substitute location could be found.

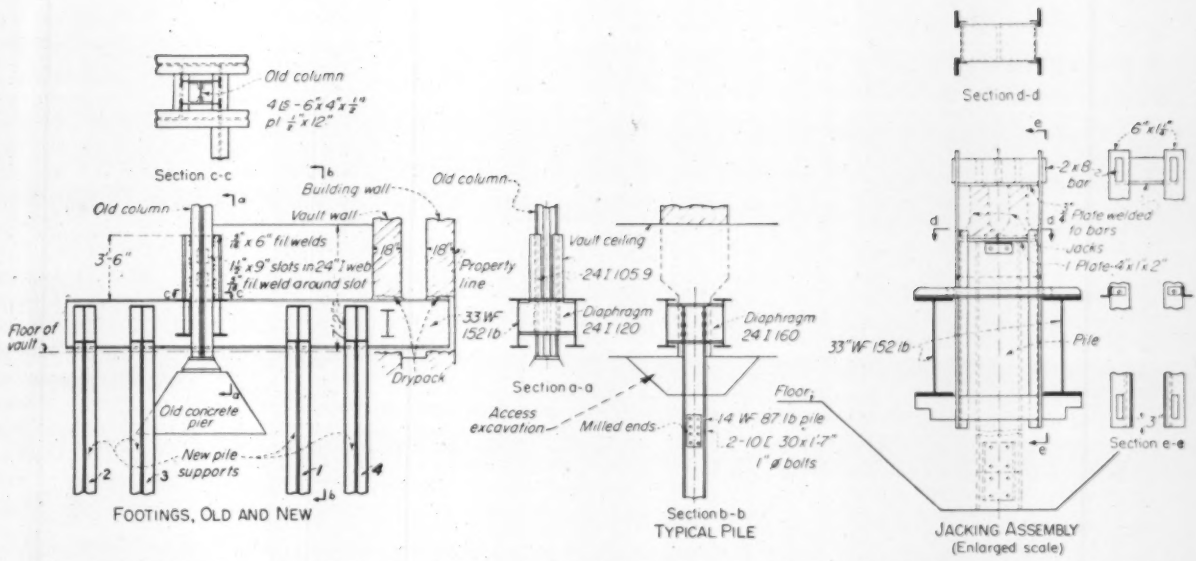
The building is a five story structure at Liedesdorff and California streets whose outer foundation walls were placed 70 years ago. It was rehabilitated after the earthquake and fire of 1906, without any changes in the footings. Later all the interior first story columns in the main banking area were removed and upper story column loads were carried on three plate girders spanning from an exterior wall to new columns located adjacent to a three-story brick vault on one side of the building. These new columns were supported by new concrete foundations (marked "old pier" in the drawing) resting on the old filled-in material which had been placed directly on a layer of mud only 10 or 12 ft. below street level.

Through the years the building settled somewhat with resultant minor cracking. Early this year the differential settlement became serious, particularly where subsidence of the three central columns adjacent to the three-story brick vault was sufficient to crack marble slabs, open quarter-inch fissures in plaster walls and prevent operation of heavy steel doors in the safe deposit vaults. Obviously, the differential settlement had reached a stage where occupation and use of the building could not continue unless immediate remedy could be found.

Support for three central columns

It was decided that if the three central columns in the 50x100-ft. structure could be firmly supported, the central portion of the building where the settlement had been greatest would be held in place and the vault doors would again be operative. Although settlement might still continue around the outer walls, it was believed that support in this central area would be sufficient to safeguard structure and occupants. The outer walls, at the present slower rate of settling, would eventually subside to, and go below the present elevation of the three underpinned columns. However, before that time it is expected that the old structure will be replaced by a new building.

Accordingly a plan was devised involving a grid of heavy steel members above a set of four steel piles to be forced down to firm support where they would take the weight previously carried by each of the three central



EACH OLD COLUMN was provided with new support consisting of four steel piles (14-in. H sections) jacked down under a pair of 33-in. beams. The assembly was welded to the old column and left in place.

building columns to the old concrete footings. This program has been successfully completed and not only has settlement at these points been entirely stopped but by careful manipulation of the jacking operation the central portion of the building frame has been readjusted so that vault doors are easily operable.

For each of the three column footings the operation was the same. The principal members of each grid consist of a pair of 33-in. steel beams placed horizontally on either side of the vertical column to be supported. Two of the assemblies used 33 in. WF 152-lb. beams, the third, 30-in. WF 210-lb. Connection between the vertical column and the steel girders was provided by H beams, as shown in the drawing, attached to the vertical column by welds run along the edges of oblong holes burned in the webs.

With connection to the steel columns above thus firmly established, 14-in. steel H sections in 6½-ft. lengths were placed beneath the 33-in. girders and were loaded by means of 300-ton hydraulic jacks to force them down to a depth of 45-ft. below the depth of the old footings. With the girders arranged as shown it was possible to place as much as 270 tons on individual H columns in this jacking operation. Jacking was continued until no further penetration could be obtained. Then, while the jacks maintained the load to prevent the ¾-in. rebound that otherwise occurred when pressure was removed, final welded connections were made. This retaining of the pressure during welding obtained, in effect, a prestressed advantage in the completed foundation.

To insure alignment and bearing, ends of the 6½-ft. lengths of the H columns were milled. As each length was added, a pair of 10-in. channels, serving as splice plates, was fastened on the 1-in. bolts through holes bored in the web in advance for this purpose.

Pressures were carefully kept below 270 tons on piles that were put down to refusal because the total building weight against which the jacks were working was only about 300 tons. Exceeding the 270-ton pressure in the jacks tended to cause uplift in the old columns.

Elevations checked

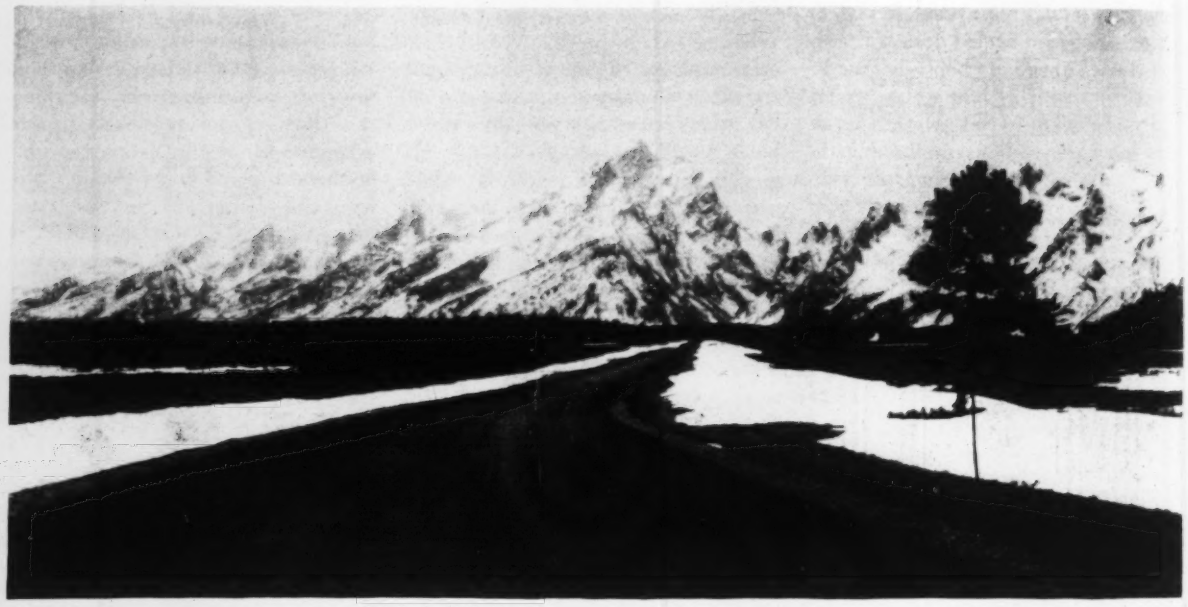
Careful observations of the level of a chisel mark on the old columns were made with a transit, checking with a number of bench marks established for the purpose. These check-up observations were made frequently when jacking pressures approached limit values.

The sequence in which the piles were jacked, indicated by 1, 2, 3 and 4 on the drawing, was followed to take advantage of the maximum weight for the first pile and later to have the benefit of any available uplift. Although the jacks could put the entire 270-ton load on an individual pile, all went down to refusal under lesser loads. Thus more than four times the working load on each pile was available for jacking, giving a large safety factor. The jacks used had a 300-ton capacity rating and a 12-in. lift. No more than an 8-in. lift was used to leave ample safety margin.

150-ton test load

A test load of 150 tons was carried on one of the piles for a 5-day period. The load was applied by three 50-ton jacks equipped with spherical top bearings to obviate possibility of side thrust. An Ames gage used in this test that was checked twice a day, showed that the variation in position of the pile under this constant load was less than plus or minus half of one thousandth of an inch.

Cost of the emergency underpinning job as a whole was about $30,000. The temporary support was designed and installation was supervised by W. Adrian, L. Graham and W. Hayes, associated structural engineers, San Francisco. Soil bearing value studies and the 5-day load test were made by Dames & Moore, San Francisco. D. J. and T. Sullivan carried out the contract for underpinning the structure.



WYOMING HIGHWAYS are maintained by state forces where no betterment of base or surface is involved.

Little Road Maintenance in Wyoming Done by Contract Methods

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EDITOR'S NOTE: Increasingly widespread adoption of the contract method for doing highway maintenance work was reported in our issue of Nov. 25, p. 67. Inquiries sent out in connection with the preparation of that article brought the following reply from Wm. E. Sutton of the Wyoming Highway Department. In that state a sharp distinction is drawn between what is "maintenance" and what is "betterment". As a result, little work that falls into the maintenance classification is done by contract; and contract performance of betterment work is only used because the state force is not large enough to undertake it.

DURING these first few postwar years it has been necessary to use every means available to bring maintenance up to a standard commensurate with use demanded of the highways in Wyoming. In 1947 Wyoming had its largest year in total dollar volume of highway improvement and, in 1948, it bids fair to again approach the ten million dollar mark. This is big money in Wyoming, and is not an average, but rather the spending of reserves accumulated during the war years.

In 1947 several betterment projects were placed under contract and, while in some circles these are referred to as maintenance items, by no means were they contract maintenance. They were betterments, since they yielded a wider road, flatter slopes, thicker bases and usually a better surface that offered more friction to the skidding tire.

In 1948, again, many miles of previously constructed highways were placed under contract for betterments. These are on fairly easy grades and good alignment, so that the general layout will not be changed. Specifications will provide that the existing oiled-gravel surface be torn up and bladed to one side and the subgrade reconditioned. Weak spots will be repaired and strengthened, a new base added—usually incorporated with the old base—and a new top added.

Wider surfaces provided

The new base will compare with the old base as the present day earth-moving scraper compares with the old horse-drawn "slip". The top or wearing courses, instead of being 20 ft. in width, will be 24 or 26 ft. Most of the minor drainage structures will be extended, or if in ill repair, will be replaced. Some call this contract main-

tenance but Wyoming calls it betterment.

There are several functions of a highway department that are necessary in the retention of the constructed road condition. Some are commonly identified as maintenance but in most states they are items of indefinite quantity, time and detail. With the many unknowns in the maintenance picture, it is not possible to obtain a contract price that can in any way compare with the cost, when the repair is accomplished by regular state forces. Wyoming has not contracted a single item of highway betterment that the highway department could not have done with greater economy with its own forces had equipment and personnel been available.

Minor work done by the state

Where minor maintenance items are concerned, it is not possible for a contractor to move his equipment to the area and do the work any cheaper than the state. The contractor must charge the overhead that accumulates between jobs, to something. The state can paint signs, cut weeds and in the winter move snow or perform normal routine snow preventative jobs. In this way personnel can be retained. In Wyoming the contractor cannot, in a large majority of cases, retain other than key men on a year-around basis.

To take specific items, such as those pertaining to the roadway proper, for example, base reinforcement, resurfacing and resealing of oiled-gravel roads, are all fairly substantial items. Usually the latter will be extensive but the first is spotty. These betterments are not planned to be done by contract methods unless there is a stretch of considerable magnitude. These are about the best comparative items for cost but if the improvement covers a fairly long distance on a high traffic route and of considerable age, then it is contracted, resulting in a better road, as the new pavement is both thicker and wider. It is of a definitely improved standard. Wyoming collects federal aid on many of these projects. Federal aid is not collectible unless the resulting project is a higher standard than the original.

Shoulder maintenance, ditch cleaning and repairing are strictly maintenance items. Unless there are other major improvement items being carried on in the vicinity it would be impossible even to get a bid. Right-of-way mowing usually is sandwiched in during a lull in some of the other activity. It must be completed by snow time, but most years are such that it is easy to accomplish this particular task.

Improved center-line striping

Center-line striping now is accomplished in Wyoming by maintenance forces, in a more satisfactory manner than ever before. A sign shop has been established and the winter months are spent in the repair of roadside signs that have been exposed to vandalism during the past year. These two functions interlace in a most satisfactory manner.

Due to the wide expanse of arid land in the state, there are few structures that come in for extensive maintenance other than surface repair. Of course, if it could be construed to call the constant repair of timber structures normal maintenance, then there is considerable work. But with the high percentage of timber structures of age sufficient to consider stringers and flooring being broken daily by excessive loads, and many of these are legal, the replacement of the broken members is almost an emergency. Hence, it is customary to refer to this as special maintenance.

Fencing is big problem

An item coming in for more attention with the economic conditions of the nation, such that the price of beef is twice as high as prewar, is the matter of right-of-way fencing and repair of that fence. The average sheepman today has to pay the herder several times the previous wage, and wool being up along with mutton makes the fence a lot more essential to the rancher. This is not meant to imply that previously these items were neglected, but rather on the great plains, there is more fence now than before.

Demands for fence are mounting and the need is likewise mounting, as the item of the dollar enters into the picture. Instead of herding, now the sheepman wants fence so that he can dispense with the herder expense. However, no contractor is interested in this, and it is difficult even to secure materials and bids for new fence on new projects.

There are countless other items in the routine maintenance that come in for their fair share of attention but they are items that in the past years have been fitted into a normal routine. There is the matter of paint on structure, realigning guard rail, replacing guard posts, and taking down snow fence that has been erected on adjacent property during the winter months. All of these are items that can under practically no stretch of the imagination be done by other than a maintenance crew.

The seasons fit highway maintenance just as they fit child-training. It is as regular as school to re-set snow fence and complete mowing on the right-of-way and to level small mounds that creep up on the up-wind side. Every hour spent in preparation repays in time and effort when the snow removing season comes.

Summarizing, Wyoming contracts major improvements and while designated by some as maintenance, the resulting work is an improved type so that it must be considered construction, with possibly a portion charged out in road life tables as maintenance. The routine items are too variable in character to even consider seeking bidders to quote. Therefore, it is difficult to strike a comparison. One item that is available is a prewar comparison of placing stone chip seal coat. Under like circumstances, maintenance costs on this item were in the neighborhood of $700 per mile while contract prices averaged $1,000 per mile.

Core Drill Standard Sizes

Diamond drilling equipment now is in the process of becoming standardized, as a result of activity by a technical committee of the Diamond Core Drill Manufacturers Association. Standards for hole sizes ranging from 1½ in. to 3 in., given below, have been adopted by the manufacturers and now are in general use. Other standards will be adopted soon.

STANDARDS

Core Diam. Nominal	Hole Diam. Nominal	Set Bit I.D.	Set Bit O.D.	Reaming Shell O.D.
⅞ in.	1½	.845	1.460	1.485
1⅛	1⅞	1.185	1.865	1.890
1⅝	2⅜	1.655	2.330	2.360
2⅛	3	2.155	2.945	2.980

Manufacturers tolerances, in the U.S.A. are ± .005 in. from above set dimensions.

Rubbish Incinerator in Residential City Satisfies Rigid Requirements

Linne C. Larson
Partner, Taylor & Taylor, Consulting Engineers
Los Angeles, Calif.

THE RESIDENTIAL nature of Beverly Hills, Calif., led city officials to impose rigid requirements on the design of a new 300-ton rubbish incinerator. Acceptance tests on the completed plant indicate that it satisfies well these requirements as well as others imposed by county agencies.

The city specified that there be no storage pit at the charging floor, that a special type dust filter be used in which continuously scrubbed gravel is the filter medium, and that the capacity be sufficient to burn all combustible rubbish collected in the city each day, with none left over. The Los Angeles County Air Pollution Control District required that not more than 0.40 grains of fly ash or solids per cu.ft. of stack gas be emitted to the atmosphere.

To understand the reason for some of these provisos, a discussion of the city and its collection system is in order.

Complete refuse-collection system

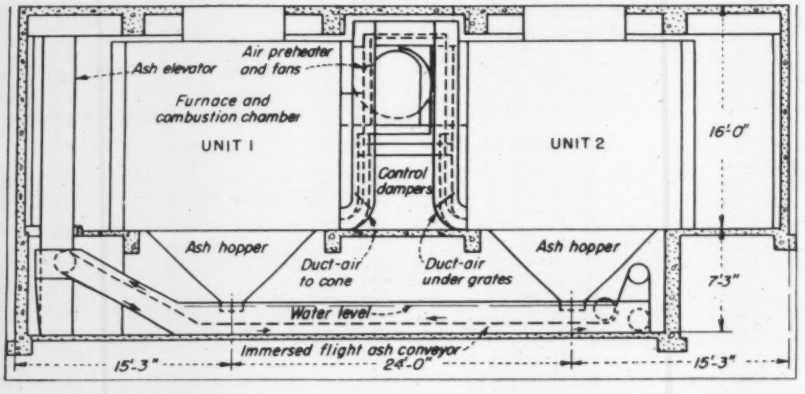
Beverly Hills, with a 1940 population of 26,823, is primarily a single-family residential community. A small business and industrial district is located about at the geographical center of the town. It has a complete, tax-supported refuse-disposal system in which all collections are made at the "rear of the buildings" and all residences and business houses are required to separate refuse. Separation is made into garbage suitable for hog feeding, combustible rubbish, non-combustible rubbish, and ashes.

Garbage is collected and hauled away for hog feeding. Non-combustible rubbish is collected, sorted and reclaimed by a private contractor, and 150 tons of paper and cartons collected from the business district is reclaimed each month by a private contractor. This leaves ashes and combustible rubbish for city collection. Combustible rubbish comprises tree trimmings, lawn cuttings, palm fronds, domestic and mercantile rubbish. This rubbish is of low density and low moisture content during protracted dry spells because of the high percentage of brush and paper and the low percentage of wet grass. To achieve the daily tonnage required of an incinerator involves a great volume of charge resulting in high heat output.

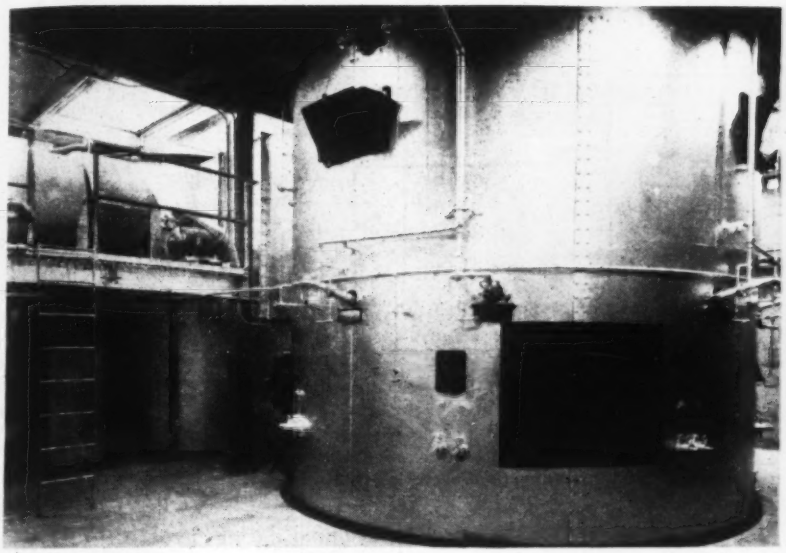
To control flies, insects, odors and nuisances, the city has not allowed use of a storage bin and subsequent rehandling of rubbish prior to charging in the furnace. It requires, further, that all rubbish be collected and burned during the daylight hours with none left over.

Beverly Hills has long employed high temperature, fast burning furnaces as the cleanest, quickest and most sanitary method to dispose of combustible rubbish. But because of city requirements, a 24-year-old plant with a total capacity of 20 tons in 8-hr. was seriously overloaded by the average collection of 80 tons per day. Accordingly, Taylor & Taylor, consulting engineers, Los Angeles, Calif., were retained to report on capacity, cost, project plan and procedure; and to prepare plans, specifications, and supervise construction of a new plant.

To handle total daily tonnage in one shift, the engineers recommended that the new plant have two furnace units each of 150-ton per 24-hr. capacity and specifications were pre-



NO STORAGE FACILITIES are provided on charging floor in the new Beverly Hills, Calif., incinerator plant. Rubbish is dumped directly into furnaces. Ashes from hoppers are quenched as they fall in a water-sealed trough with automatic conveyor.



THE 150-TON PER 24-HR. FURNACES at left center on a slowly rotating cone, at right. Stoking arms extending from the cone push refuse out to the grates. Length of the arms can be varied, and pitch is adjustable.

pared and bids called on this basis. On Nov. 6, 1946, a contract was awarded to the Nichols Engineering & Research Corp., New York, N. Y., with the design centering around the Nichols-patented furnace, the mechanically stoked Mono-hearth. Price was $316,680 but an escalator clause with a $348,000 ceiling to account for increase in labor and materials resulted in a final cost of $334,253.40. Construction started on Mar. 15, 1947, and the plant was officially accepted by the city on Apr. 27, 1948.

The plant is located on a 150x350-ft. lot on an important through street, within two blocks of exclusive residential districts. It has three levels. The upper or ground floor level is devoted to charging furnaces, the lower floor is for operation of automatically stoked furnaces, and the basement is an ash tunnel for receiving residue.

In absence of a storage bin, furnaces are charged intermittently as trucks unload on the floor. Truck arrivals average one every 10 to 12 min. Rubbish is dumped or pushed through a 3x7-ft. opening in the top of each furnace. A refractory-lined door mounted on wheels and tracks covers the opening. The door is motor-operated and controlled from a pushbutton station.

The charging floor is designed so trucks can back into the plant and discharge directly into the furnace. It also can accommodate loads dumped and stored on the floor, allowing the truck to unload immediately if the furnace is full. A rubber-tired tractor with a pusher blade then charges the furnaces.

Two mechanically stoked units

Each furnace contains a mechanically stoked unit designed to incinerate 150 tons of rubbish each 24 hr. These are contained in vertical cylinders of 15-ft. outside diameter with walls of 9-in. fire brick and 4½-in. insulation encased in a 3/16-in. steel shell. Grates are 9¼ ft. below the furnace roof and 3 ft. above operating-floor level. Total area of each furnace inside the brick wall is 125.5 sq. ft. and, at rated capacity, this results in a combined drying and burning rate of about 100 lb. per sq. ft. of area per hour.

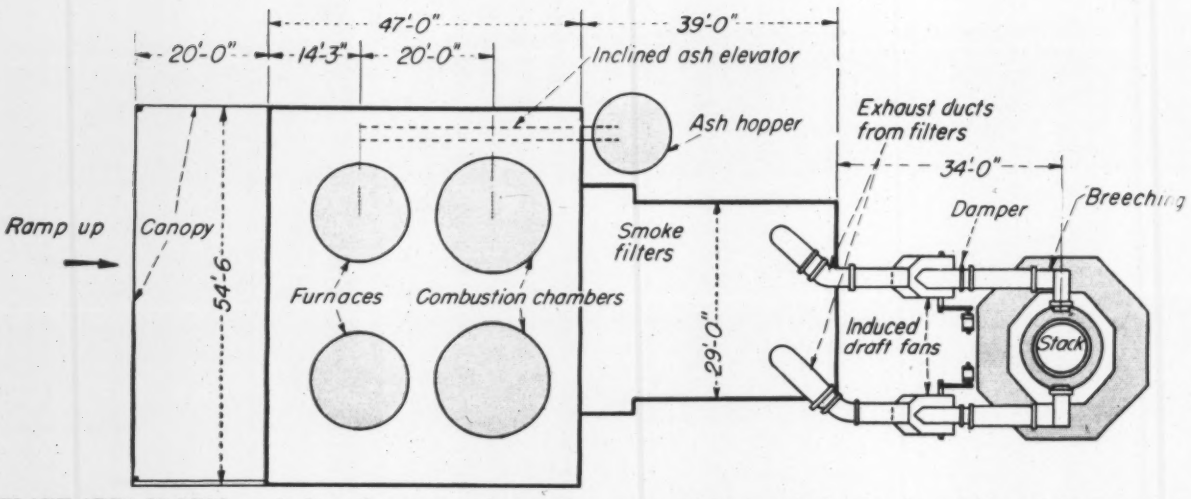
Extending above the grates in the center of the furnace and directly below the charging hole is a slowly revolving cast-iron cone about 3 ft. high. Two stoking arms attached to the cone move material out toward the periphery of the furnace. Short or long arms can be used as experience indicates; pitch of arms is adjustable. The cone is driven by a ¼-hp. motor through a worm gear reducer and a hollow vertical shaft. A shear pin is provided in the drive shaft outside the furnace in event of an obstruction in the furnace. Air for forced-draft combustion is blown through the central shaft, revolving cone and stoking arms for cooling.

Surrounding the central shaft below the cone and arms is a circular, solid cast iron hearth. In the annular space between the central solid hearth and furnace walls is a series of sixteen cast-iron dumping grates. These are arranged in eight pairs so that there is an opening of some 18x30 in. when one pair is open. Convenient handles outside the furnace can be used for quick, easy dumping.

The two furnaces discharge combustion products through separate combustion chambers, cooling chambers and dust filters. To overcome friction through dust filters, each unit has an induced draft fan of 35,000-cfm. capacity at 600 deg. F. driven by a 50-hp. motor. These fans discharge into a common stack 110 ft. high.

Structurally, combustion chambers are similar to furnaces except that they are 17 ft. outside diameter. Volume of each chamber inside the brick walls is 1,985 cu. ft., equivalent to 13.2 cu. ft. per ton of refuse burned per 24 hr.

Each furnace is provided with a forced-draft fan driven by a 10-hp. motor to provide air for combustion, either heated or at outside air temperature. An air-gas mixer raises air temperature from 70 to 400 deg. F. by using waste heat in gases after



PLANT AREA IS LESS—only 9 sq. ft. per ton of capacity as compared with 15 sq. ft. for old plant. Inclined conveyor takes quenched ashes to ash hopper high enough to charge directly to trucks.

they have passed through the combustion chamber. This hot gas is mixed with air from the operating room; mixing is regulated by a damper controlled from the operating floor.

Mechanical ash-handling equipment

Ashes from furnaces are dumped into an ash hopper located beneath each unit. This in turn discharges into a scraper-conveyor trough filled with water to form an air and gas seal below the hopper. Water in the trough thoroughly quenches the ashes and prevents dust in the ash tunnel or in conveying and trucking. The conveyor system hauls the ashes to a bin located outside the plant, from which they can be discharged into trucks for disposal.

Although similar furnace units have been used for burning garbage weighing as much as 600 lb. per cu. yd., the Beverly Hills service is unusual because of the low density of the rubbish charge. Rubbish burned during acceptance tests averaged some 180 lb. per cu. yd. Because of light weight and low moisture content, volume of rubbish required to achieve rated capacity was much greater than in a normal incinerator.

Test results for burning rubbish only gave a capacity of 300.27 tons per 24 hr., a heat release of 2,460,000 B.t.u. per minute with production of 119,050 cu. ft. per minute of gas at 600 deg. F. These figures, slightly altered for a mixture of 75 percent rubbish and 25 percent paper-wrapped garbage, are practically double those usually obtained when burning a normal rubbish-garbage mixture. Highly combustible, dry refuse was used in the tests.

By weight, rubbish burned included 26 percent paper, 69 percent brush and 5 percent grass. This amounted to 26.1 percent moisture, 68.5 percent combustibles and 5.4 percent ash. Results indicated that about 13 or 14 percent of refuse burned ended up as ashes.

Plant construction costs are given in an accompanying table. Operating costs during the tests were computed as number of man-hours, power and water used per ton of material burned. This amounted to 0.960 man-hours, 9.630 kwh., and 54 cu. ft. of water. No auxiliary fuel was required during the tests.

As this is written, the plant has been in successful operation for almost a year and no complaints have been registered by townspeople.

The limitation by the county on fly-ash emission led city officials to specify the special gravel-filled dust filter. A similar filter had been used successfully on the old plant, and such a unit was guaranteed by its inventor to meet the new requirements.

None of the incinerator companies that submitted bids offered a substitute for this filter and none would guarantee emission of fly-ash and solids within the specified limits. Representatives said they had never before been called upon to meet regulations as rigid as those here imposed.

Because of insufficient draft, the

COSTS OF 300-TON INCINERATOR

Item	Cost	Cost per Ton Capacity	Percent of Total Cost
Excavation, backfill, compacted ramps and disposal of surplus dirt	$ 10,702.00	$ 36.00	3.30
Reinforced concrete building	75,549.88	252.00	22.67
Electrical work	17,552.00	58.00	5.27
Steel chimney, including foundations, lining and painting	29,292.00	98.00	8.85
Filter units, including foundations	38,085.57	128.00	11.54
Induced draft fans and motors	9,461.00	32.00	2.93
Incinerator units, including brickwork	116,948.70	390.00	34.21
Ash conveyor system	12,553.00	42.00	3.83
Ash storage tank	3,661.50	12.00	1.14
Forced draft fans and motors	5,854.00	19.00	1.77
Gas burners for auxiliary fuel	5,440.00	18.00	1.68
Instruments and controls	3,138.75	10.00	0.96
Paving, retaining wall and clean-up	6,015.00	20.00	1.85
Total	$334,253.40	$1,115.00	100.00

gravel was removed from the filters during the test runs and still the plant met the rigid fly-ash requirements.

Briefly the filter operates as follows: Gases from the combustion chamber pass through the voids in selected size gravels, thus removing fly-ash and other particles. The gravel is continuously circulated through cleaning screens by screw conveyors and a bucket elevator. Since the filter is not insulated, water sprays are provided in the flues just ahead of the filters to control temperatures. Thermocouples automatically control water sprays to limit the gas temperature to 300 deg. F.

Failure of the filters during the tests was attributed to extra dry refuse available at that time and the friction developed because of small gravel size.

Test results averaged 0.147 grains of solid matter per cu.ft. of stack gas while the plant was operating at rated capacity. This is well within the top limit of 0.40. It is believed that the excellent results obtained during the tests in spite of the absence of gravel was because of the filter structure and flue system just ahead of it. Spray cooling and many directional changes in the resulting gas route accomplished excellent fly-ash impingement and consequent reduction of resultant solids.

Tests are now being conducted on filters to determine proper size of rock and proper speed of induced-draft fans to obtain satisfactory draft and operation of furnaces if filters are to be used.

Personnel

Operation and maintenance of the new plant is under the direction of H. J. Scott, superintendent of maintenance for Beverly Hills. General contractors were the Nichols Engineering & Research Corp. of New York. For the Nichols firm the project was supervised by Sam Burgess, vice-president, and E. V. Tait, construction engineer. C. W. Nichols, chairman of the board, and R. W. Rowen, vice-president, supervised tuning-up and acceptance-test runs. Taylor & Taylor, consulting engineers, Los Angeles, Calif., who prepared the plans and specifications and supervised construction were represented on the work by Carl B. Johnston and the author.

Do Our Estimates Cost Too Much?

R. D. Sannit
Buffalo, N. Y.

Do our estimates cost too much?

The answer is an emphatic yes! But, I doubt if any of us realize just how costly our present estimating methods really are.

Let us examine the entire system.

An architect or engineer designs a building. He prepares plans and specifications for its construction. He then gives these to several general contractors for competitive bids. The general contractors, in turn, solicit bids on all trades from the various sub-contractors. In some trades, they may get five or more sub-bids.

In preparing an estimate, the contractors spend most of their time on the quantity survey work. That is, on taking off materials for pricing. Each of the competing general contractors takes off the work his firm intends to do itself if awarded the contract. And all the sub-contractors take off their own work.

In that way, some items may be taken off fifty or more times by different firms between the preliminary estimate and the final completion of the job.

This duplication — expensive though it is—is only one factor contributing to the high cost of estimates. Others are discrepancies, errors, and omissions on the drawings, as well as obscurities and ambiguities in the specifications. These other factors probably are inevitable in our current system; and they cannot all be resolved before the bid date. As a result, they are costly to the contractor if he overlooks them and gets the job. They are equally costly when he allows too much for them in his bid, and thereby loses the job.

Thus, the quantity surveys we produce today are entirely too costly, and inaccurate besides. We would do well to correct this condition ourselves. For, if changes are brought about by outside economic forces—as well they might be—we in the industry will find ourselves at a decided disadvantage.

In trying to remedy the situation, we should look for a method that will retain the benefits of our competitive bidding system while eliminating the waste and inaccuracies of its current estimating procedure.

I feel there is such a solution in the Guaranteed Quantity Survey System. Here is a brief outline of the plan:

Let us first train our estimators properly. We can do so through careful schooling at college, followed by a supervised on-the-job program with architects, contractors, and sub-contractors. Such training will raise estimators' professional status.

Then let these men be licensed to work as consultants to architects in the same way that structural and mechanical engineers do. They will prepare the quantity surveys for all trades (except excavation). They will list the materials and work for direct pricing in the exact manner used by each trade.

The architect will issue the quantity surveys under his own name. He will give them to the general contractors when the job is advertised for bids. The general contractors will distribute these to the subcontractors, and will bid the job in lump sum as they now do. Their bids, however, will be based on the plans, the specifications, and the quantity survey. And all three will become part of the contract documents when the job is awarded.

The plan is practical. It is not so revolutionary when examined in detail.

We know there is only one correct quantity survey for any building an architect designs—that is the exact amount of materials that will be incorporated in the building when it is completed. This amount can be predetermined accurately from the plans and specifications—if they are adequately prepared, and, if a system of controlled takeoffs is followed. The single quantity survey thus produced can be set up to serve all requirements for the duration of the project—from the budget estimate through the bidding stage, the ordering of materials, scheduling of work, and finally the partial payment estimate.

The main idea is that the quantity survey is to be guaranteed to the contractors bidding the job. This can be done safely if the estimators are

thoroughly trained and if they use a careful system of checking. All variables, such as waste and equipment, in connection with the installation, will remain for the judgement of the contractors figuring the work. Only what is actually placed in the completed building will be included in the quantity survey.

Everyone in the construction industry stands to gain from a guaranteed quantity survey system.

The general contractor's office work will be leveled off from the peaks of mad rush just before a bid opening His office overhead will drop considerably, as most of the expense of figuring jobs is in the quantity survey. He will be able to figure as many projects as his bonding capacity will allow rather than as many as his overworked estimating staff can turn out. He will not be subject to errors of omission by his own staff or by those of his competitors, which cause them to take work away from him below cost. Finally, he will be taking less risk with subcontractors who submit low bids on poorly prepared estimates, then want to back out when offered the contract.

In effect, all competing contractors and sub-contractors will be figuring on the same quantities rather than on their own version of what the building contains. Isn't the theory of competitive bidding based on all firms submitting figures on the same thing?

A check on the plans

The architect will turn out plans and specifications that are minutely checked and corrected before he issues them for bids. This will eliminate much of the complicated addenda we now see. And it will dispense with most of the costly change orders and extras. Quantity surveyors give the drawings and specifications the most practical check they can get before actual construction. The architect will be getting the full benefit of this check. It is much easier and far less expensive to make the changes on the drawing board than in the field.

The owner will benefit in many ways. He will pay less for estimating work. And he will be paying only for the estimating of his own job. In spite of our present policy of "free estimates," the owner really pays for the work as part of the contractor's overhead charge. (A contractor sometimes figures ten jobs before he gets one.) The owner will also benefit through earlier occupancy of his building, for the time allowed for estimating will be cut considerably. On a large project, two to three weeks saving in time is valuable.

System needs study

The guaranteed quantity survey system is a new idea. It needs a lot of planning and preparation before we can put it into operation. We know that our present estimating methods are far below the standard of efficiency and accuracy we have achieved in our other construction processes. But we cannot rush changes without careful investigation. There is t much at stake.

As the initial step toward t needed reforms, we might make careful survey of estimating pro dure throughout the country. We c gain much by getting the opinions all concerned. To my knowled nothing along this line has been a tempted as yet.

At present, any lowering of cos is welcome. So we will be doing th industry and ourselves a great servi by making a start in that direction. has been done in the modular syste for coordinating the dimensions o building materials, so there is no rea son why we cannot do it in estimating.

Notes on Legal Decisions

Summaries of decisions relating to construction prepared by I. Vernon Werbin, counselor at law and engineer, New York

General Contract Reference

When a subcontractor undertakes to perform part of the work according to the plans and specifications which constitute a part of the general contract, such plans and specifications become a part of the subcontract. This is true at least to the extent that the subcontractor assumes the obligation of the general contractor in relation to the particular part of the work that he performs[1].

A reference in a subcontract to the general contract for a particular purpose makes it a part of the subcontract only for the purpose specified[2].

(1) Ehret Magnesia Mfg. Co., Inc., v. Gothwaite, 149 F. 2d, 829.
(2) Guerini Stone Company v. P. J. Carlin Const. Co., 240 U. S. 264, 60 L. ed. 636.

Payment to Subcontractor

Where the general contractor abandons the work or fails to make payments due a subcontractor, a promise made by the owner to pay the subcontractor will be enforced if he will complete the work.

While as a general rule a promise to perform a pre-existing obligation under a contract does not support a promise to pay additional compensation for the performance of the same work, the rule does not apply where the promise to pay is made by a person not a party to the original contract. This is particularly true where the promisor will benefit by the performance of the work in question[1].

(1) Reisler v. Silbermintz, 99 App. Div. 131, 90 N.Y. Suppl. 967. Joseph Lande & Son, Inc. v. Wellsco Realty Inc., 34 A.2d 418.

Overhead in Breach of Contract

Where a contract has been breached by the owner, and the contractor elects to abandon the work and seeks to recover the value of the work actually performed, overhead will be allowed as an element of damage. In one case, where value of work performed was $14,000, an allowance of 10 percent for overhead was held to be neither arbitrary nor unreasonable[1]. In another case, involving $21,500, an allowance of 6 percent for overhead was upheld. The amount for overhead is computable by experience and the question of the fairness of the amount allowed is for the court or the jury[2].

A contractor may recover increased overhead costs resulting from delays caused by the acts of the other party[3].

(1) Sofarelli Bros. v. Elgin, 192 F. 2d 785.
(2) Elias v. Wright, 276 F.908.
(3) Phoenix Bridge Co. v. United States, 85 Ct. Cl. 603.

FIELD AND OFFICE

Lines Planimeter

Irregular areas on paper may be measured simply by the lines planimeter, an office-made device that applies the principle of graphic area summation.

The lines planimeter consists of two elements, both of which may be drafted or engraved on a single piece of transparent material four or five times as wide as the least overall width of the area to be measured. The first element (Fig. 1), the net, is a series of parallel lines spaced uniformly a scalar distance apart (e.g. $\frac{1}{10}$ in. = 2 ft. for scale 1 in. = 20 ft.). The second element, the transversal scale, (Fig. 2), is a set of horizontal, vertical and diagonal lines arranged for measurement of line length.

In operation, the net is fixed over the area to be measured. The lines break the figure down into trapeziums, each of an area which is the uniform line interval multiplied by the mean base, or median distance. The figure area is the line interval multiplied by the summation of the median distances.

A pair of dividers measures the cumulative median distances up to the limit of the dividers' spread, as follows: First, measure B-A; then transfer the left point of the dividers to B_1 and mark at A_1; then spread the left point to C_1 for $C_1 - A_1$, which is the sum of the first two medians; then transfer the dividers, left point to B_2, mark A_2, and spread the left point to C_2, etc. In the figure, C_4A_4 represents the maximum spread of the dividers. This length multiplied by the interval gives the area of the first five trapeziums.

The multiplication, however, is eliminated by use of the transversal scale, on which the last dividers distance, C_4A_4 is laid for direct area reading. This reading is possible because area in this case is a function of the first power of the median summation, hence the area may be represented by a straight line. The transversal scale is drafted to a scale such that the horizontal dimension of each half represents 100 sq. ft. (or any multiple of 10). The left half is divided into ten equal spaces, each representing 10 sq. ft. in the horizontal. The horizontal lines make ten equal horizontal strips (no scale) and their intersections with diagonal lines indicate even feet. Thus, the area represented is 100 plus 60 plus 6: 166 sq. ft.

The precision of the lines planimeter is 0.33-0.5, percent of the area, according to Hartner-Dolezal, Vienna, 1910, Vol. I, pt. 2, p. 1054. This precision is sufficient for many cases of practical work. Most important, however: the lines planimeter takes only a short time to construct, and costs nothing.

For engineers who frequently must measure the areas of irregular figures a commercial "thread" planimeter operating on the above principle is available.—SERGE A. EMERY, *169 East Second St., New York 9, N. Y.*

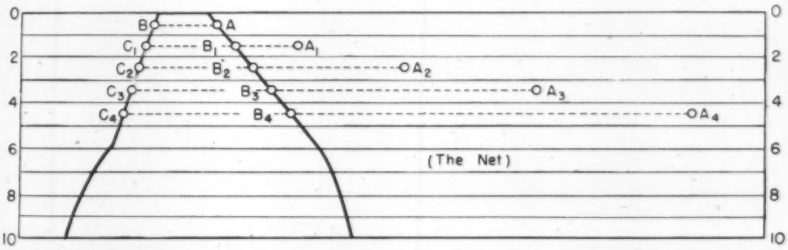


FIG. 1. EQUIDISTANT parallel lines traced on transparent material constitute the first element of the lines planimeter

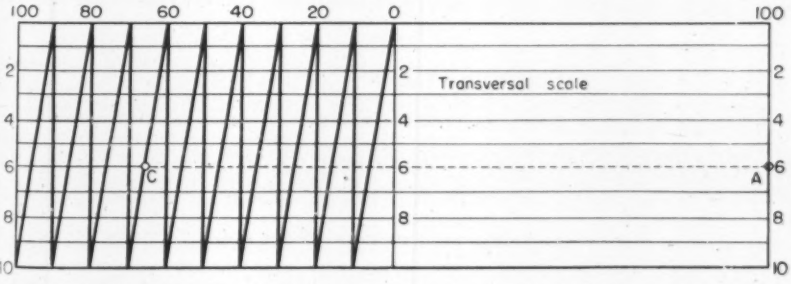
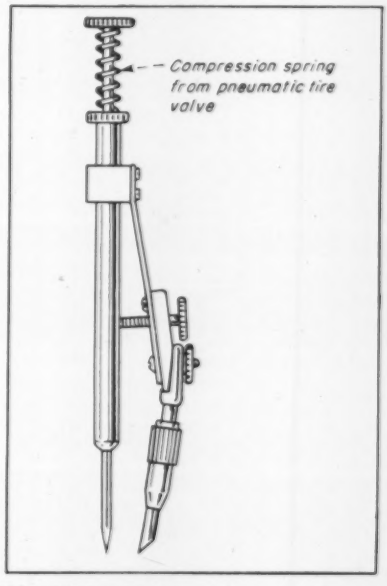


FIG. 2. THE DOTTED LINE laid off on the transversal scale represents an area of 166 sq. ft.

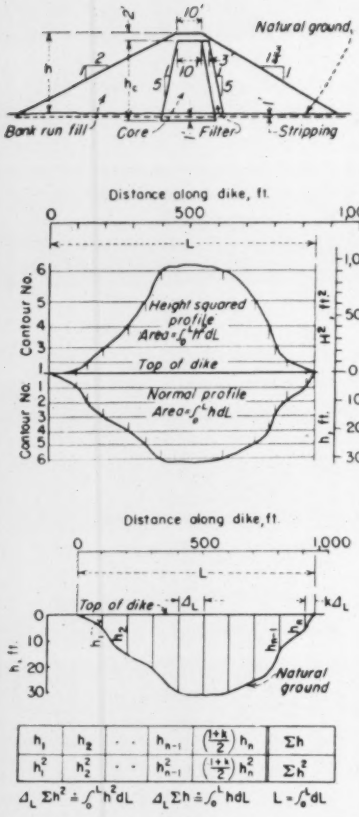


DRAFTING-ROOM AID — Heavy circles can be drawn with a single spin by spring-loaded drop bow compass. The spring has just enough tension to make a firm line. It is not used with the pen. — E. L. Hemenway, *Ridgefield, N. J.*

Composite Earthwork Computation Simplified

Preliminary earthwork estimates commonly are made by computing the end areas as functions of the center height. The center height is taken off a topographic map or a profile, and the simplifying assumption is made that the cross-sectional ground is level.

In the case of fills containing several types of material wherein the



A COMPOSITE DYKE cross-section (top), function of *h* profiles (center), and a summation setup for *h* and h^2 (bottom).

volume of each is desired, the arithmetical work can be considerable unless a method such as the one presented here is used.

For the embankment shown in the top drawing, the areas of the various materials can readily be written as functions of the height h in the general form:

$$A = ah^2 + bh + c \qquad (1)$$

and specifically:

$$\begin{aligned} A \text{ (bank run fill)} &= 1.675h^2 + 1.15h + 24.675 \\ A \text{ (core)} &= 0.2h^2 + 10h \qquad (1') \\ A \text{ (filter)} &= 3h - 3 \\ A \text{ (stripping)} &= 3.75 + 13.75 \end{aligned}$$

The volume of each of the materials is found by integrating the area throughout the length L of the embankment:

$$V = \int_0^L A\,dL = \int_0^L (ah^2 + bh + c)\,dL$$

$$\text{or } V = a\int_0^L h^2 dL + b\int_0^L h dL + c\int_0^L dL \qquad (2)$$

Specifically:

$$\begin{aligned} V \text{ (bank run fill)} &= 1.675\int_0^L h^2 dL + 1.15\int_0^L h dL + 24.675L \\ V \text{ (core)} &= 0.2\int_0^L h^2 dL + 10\int_0^L h dL \qquad (2') \\ V \text{ (filter)} &= 3\int_0^L h dL - 3L \\ V \text{ (stripping)} &= 3.75\int_0^L h dL + 13.75L \end{aligned}$$

It is to be noted in equation (2) that the coefficients a, b, and c are dependent only upon the shape of the cross-section, and the integrals are dependent only upon the profile of the ground and the elevation of the top of the embankment. The coefficients are different for each material within the dike, but the integrals are the same.

From the properties of the dike, equations (1′) and (2′) are readily written. The next step is to evaluate the integrals. Two general approaches are available, integration and summation.

Evaluation through integration can be accomplished with mechanical integrators. The integral $\int_0^L dL$ is equal to L, the total length of dike. The integral $\int_0^L h dL$ is equal to the area included between the top of the dike and the profile of natural ground along the dike axis. This area can be measured on the profile with a planimeter. The integral $\int_0^L h^2 dL$ is equal to twice the moment of the profile area taken about the top of the dike. This moment can be measured with a mechanical moment integrator, or a height-squared profile can be substituted. On the normal profile shown in the middle drawing, using the top of the dike as an axis, uniformly spaced contours are ruled and numbered consecutively. Similar contours are ruled above the axis except that they are spaced at intervals of 1, 4, 9, 16, 25, etc., and labeled with the square root of their spacing. Points of intersection of the normal profile with the lower contour lines are projected vertically to the correspondingly numbered contours above the axis. The new points are connected to form the height-squared profile. The area of this profile as measured by planimeter is equal to $\int_0^L h^2 dL$. Care must be taken to use correct factors for conversion from planimeter readings to areas.

Evaluation of integrals by summation is a familiar operation. Equation (2) can be written:

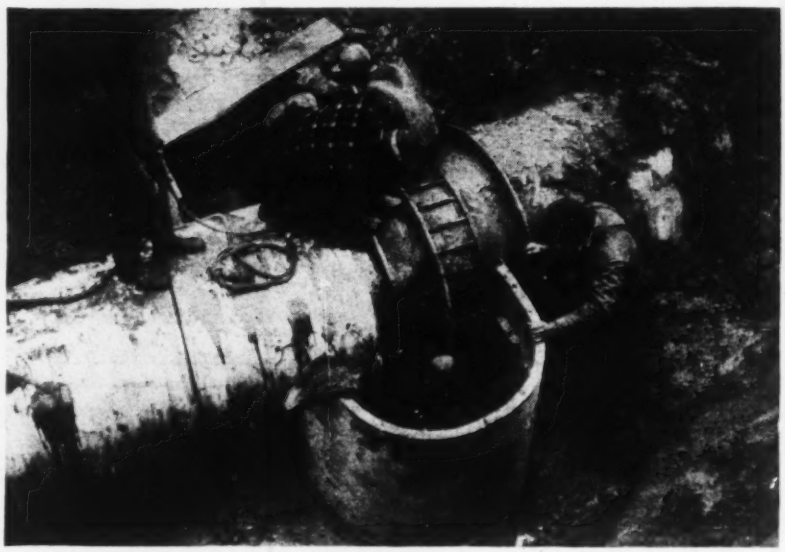
$$V = a\Sigma h^2 \Delta_L + b\Sigma h \Delta_L + cL \qquad (2a)$$

If uniform increments are chosen, Δ_L can be factored and Equation (2a) becomes:

$$V = a\Delta_L \Sigma h^2 + b\Delta_L \Sigma h + cL \qquad (2b)$$

The method of evaluating the summations is indicated in the lower drawing.

The values of the integrals as found by either method are substituted in equation (2) together with the proper coefficients a, b, and c for each material. The volumes are then readily obtained.—KENNETH E. SORENSEN, *400 W. Madison St., Chicago, Ill.*



Steel Sewer Form Protects Workmen

IN DEEP CUTS, steel U-shaped sewer forms were used to protect workmen making joints on a 55-in. steel water-supply conduit for Syracuse, N. Y. from treacherous slides.—Elon P. Stewart, division engineer for water, Syracuse, N. Y.

READER COMMENT

Chides "Student Engineer"

Sir: Two junior civil engineers, one year out of college and working in South America for a U. S. company, were slightly amused when they read "Young Engineer's Outlook" in your Sept. 2, 1948, issue.

Even if you don't publish this, you might send it to "Student Engineer", who assumes so many pleasant things on foreign jobs, like: "It is tempting to clear $400 a month"—even without the ping-pong table"—which we don't have ("with no place to spend it")—which we do have—"and wind up with three years experience. . . "

Show me a foreign job where they pay $400 for a college education and no or little experience, and show me the place where you don't spend any of the $400! I'll take the job within a month.

We also discussed the second part of his letter and in particular where he says, talking about state engineers: "Ninety percent of the field and office work can be done by well trained technicians". Although we agree with his statement we have reached the conclusion that ninety-five percent of the time the "trained technician" unluckily happens to be a Junior Civil Engineer.

But don't get discouraged, "Student Engineer", you can always take a job as an apprentice bricklayer in New York with a present final salary outlook of $27 a day.

JUNIOR CIVIL ENGINEER
Somewhere in Chile

Facts on Spanish Hydro Projects

Sir: We have recently noticed a statement in your issue of June 3, 1948, on page 4, concerning hydroelectric installations in Spain. This statement requires some correction. The sentence to which we draw your attention reads as follows: "The Spanish government has recently completed and put into operation two dams on the River Ebro to shorten the course of the river and create the necessary head for four groups of turbo-generators rated at 57,200 hp."

The installations referred to above were built and financed by private companies. The Flix installation is on the Ebro River, and was built by the Saltos del Ebro S.A., which is one of the companies in the Barcelona Traction Light and Power Company, Ltd., group, all of which companies are entirely privately owned. The Ribesalbes installation is located on the Mijares River, north of Valencia, and was built by Compania de Luz y Fuerza de Levante.

The Flix installation consists of a dam which cuts off the river and diverts it through a tunnel to the power house, a navigation tunnel which assures the continuity of navigation on the river, and a power plant which is equipped with four generating units of a total capacity of 56,000 hp.

Our company was consulting engineer for this project, and has acted in this capacity for the Barcelona group since 1932.

You have undoubtedly obtained the misinformation quoted above from an erroneous report, and thus we would appreciate your correction of the statement in an early issue.

UN ADMINISTRATEUR-DIRECTEUR,
Société Financière de Transports
Et D'Entreprises Industrielles
Brussels, Belgium

Early CPR Surveys

Sir: The contributions made by engineers to the construction of the Canadian Pacific Railway are almost completely overlooked in the three articles on that railway system in current issues of the SATURDAY EVENING POST.

For the readers of ENGINEERING NEWS-RECORD who saw these articles, the facts are briefly as follows: Sandford Fleming, chief engineer of the Inter-Colonial Railway, was appointed chief engineer of the Canadian Pacific Ry., in 1871, ten years before William C. Van Horne came into the picture. In that capacity he conducted the surveys for the proposed Canadian Pacific Railway. As an initial exploratory step, Fleming traveled 3,300 miles through the wilderness from Montreal to Victoria in ninety days. There followed in order the exploratory survey, the revised survey, the trial location, the location survey, and, finally, the revised location. For seven years these surveys were in progress, with twenty to twenty-five engineering survey parties in the field, winter and summer, under most severe conditions.

The engineers under Fleming examined 46,000 miles of territory, most of which was previously unexplored by a white man. Thirty-four of these men lost their lives in the seven years, by drowning, by forest fire, avalanche and snow slides, or by exposure to temperatures as low as 46 degrees below zero. Two years' salary was paid by the government to the family of each man who lost his life. Chief Engineer Fleming made sure of this, often paying the money first and consulting the government afterward.

Fleming was personally conducted through Rogers Pass in the Gold Range by Major Rogers himself. It was in 1881 that William C. Van Horne (later Sir William Van Horne) was engaged as general manager for the Canadian Pacific. To Sandford Fleming (later Sir Sandford Fleming) as chief engineer from 1871 on must go much of the credit for the successful location, design and completion of the 2,906-mile rail line through trackless wilderness.

ERIC FLEMING
New Brunswick, N. J.

P.S. A letter just received from Temple Fielding, author of the articles on the CPR, states that reference to Sandford Fleming was in the original manuscript but was eliminated by the editors of the SATURDAY EVENING POST in condensing the manuscript. E. F.

Correction

Co-authors of the article "Planning Fire-Sprinkler Installations" in the November 25 issue of *ENR*, page 57, are John Coleman and Dawson Powell, of the Grinnell Company, Inc., Providence, R. I.

Their names were inadvertently omitted from the heading of the article in the typographical assembly of the page.

BOOK REVIEWS

Control of Environment

PUBLIC HEALTH ENGINEERING—By Earle B. Phelps. 655 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. $7.50.

The specialized field in which engineering principles and techniques based upon biological data are employed in the practice of public health constitutes the field of public-health engineering. This is the way Earle B. Phelps defines the scope of the subject on which he has based his book and in which he has been a pre-eminent educator for several decades.

Dr. Phelps goes on to point out that this field is one that deals essentially with control of the environment, with those modifications and protective and preventive measures that have been found desirable and necessary for providing optimum conditions for health and well-being. These environmental factors are broadly classified as the "air contact" and the "water contact."

Several specialists have collaborated with Dr. Phelps in writing the first part of the book in which air-contact factors are discussed. These include: Weather and climate; air supply and thermal environment; heating and air-conditioning; illumination and lighting; atmospheric pollution; noise; and insect control. All of these chapters will prove to be significant and broadening to engineers.

The second half of the book, written by Clarence J. Velz, deals with the water contact. This involves water supply, sewage and waste disposal, which will be recognized as the more orthodox subjects with which sanitary engineers are concerned. But Professor Velz, who is head of the department of civil engineering at Manhattan College, does not treat these subjects in orthodox fashion. He brings to his readers the benefit of original thinking on many aspects of his subject, and what he has to say will be found useful and stimulating.

Dr. Phelps sums up the content of this book in the following statement, with which this reviewer finds himself in agreement: . . . . "It deals with principles rather than with engineering practice. It is written primarily for the engineer who presumably has learned how to design and build, to teach him, in the light of present-day knowledge of sanitary sciences, what to design build and why."

Abbreviations and Signs

SCIENTIFIC AND TECHNICAL ABBREVIATIONS, SIGNS AND SYMBOLS—By O. T. Zimmerman and Irvin Lavine. 476 pp. Industrial Research Service, Dover, N. H. $7.50.

This book is probably the most complete compilation yet made of abbreviations and symbols used in engineering and scientific literature. Included, in addition to the abbreviations of the American Standards Association, are those of the American Railway Engineering Association, National Lumber Manufacturers Association, U. S. Soil Conservation Service, the Weather Bureau, and other government agencies and scientific organizations.

For convenience in use there is a large general list which is followed by special sections on such subjects as mapping, railways, military, aviation and electric wiring.

Miscellaneous Notes on Booklets and Reprints

FRENCH STEELWORK SPECIFICATIONS—For anyone contemplating structural steel design in France, or just curious about the French requirements in this field, a copy of the 80-page Commentaires des Regles D'Utilization de L'Acier will be indispensable. Although a textbook in style, it is in effect the specification required for all work done for the Ministry of Reconstruction and City Planning. Available from the Institut Technique du Batiment et des Travaux Publics, 28 Blvd. Raspail, Paris 7, France, for 330 francs. A companion manuel of steel erection is under preparation.

A MANUAL OF WIRE ROPE and wire rope uses has been made a part of the special issue of "Wickwire Rope," issued by the Wickwire Spencer Steel Division of the Colorado Fuel & Iron Corp., in connection with the fiftieth anniversary of rope making at its plant at Palmer, Mass. The correct applications of wire rope to the principal types of construction equipment are covered by diagrams and tables. Copies can be obtained from the Wickwire Spencer Steel Division, Palmer, Mass.

METHODS FOR USING PENS, brushes and India ink in illustrative work are described in the fifth edition of "Techniques," which is issued by the Higgins Ink Co. Brooklyn 15, N. Y., for $1.

New Engineering Books

THE MATHEMATICAL SOLUTION OF ENGINEERING PROBLEMS—By Mario G. Salvadori. 245 pp. McGraw-Hill Book Co., New York 18, and London. $3.50.

PRODUCTION CONTROL—Second Edition—By L. L. Bethel, W. L. Tann, F. S. Atwater and E. E. Rung. 289 pp. McGraw-Hill Book Co., New York 18, and London. $3.50.

THE SHIPWRIGHT'S TRADE—By Sir Westcott Abell. 219 pp. Cambridge University Press, London; The MacMillan Co., New York. $4.50.

SOIL EROSION—ITS PREVENTION AND CONTROL—184 pp. By the Development Department, Government of Madras, Government Press, Madras, India. Price, 6 rupees (Approximately $1.81).

DESIGN OF INDUSTRIAL EXHAUST SYSTEMS—Second Edition—By John L. Alden. 252 pp. The Industrial Press, 148 Lafayette St., New York 13. $3.50.

PUMPCRETE PRACTICE—A Manual of Pipe Line Concreting Methods—Third Edition. 193 pp. Chain Belt Co., Construction Machinery Division, Milwaukee, Wis. $5.

SMALL HOUSE CARPENTRY—By Lee Frankl. 100 pp. Prentice-Hall, Inc., New York. $2.95.

ENGINEERING DRAWING PROBLEMS—Series One—Prepared by C. D. Cooper, P. E. Machovina, and C. J. Vierck. McGraw-Hill Book Co., Inc., New York 18 and London. $3.50.

Reports and Pamphlets

STANDARD SPECIFICATIONS FOR READY-MIXED CONCRETE—National Ready Mixed Concrete Association, 1325 E Street, N. W., Washington, D. C.

CONCRETING AND BRICKLAYING IN COLD WATER — Bulletin No. 3 — National Building Studies (Great Britain). His Majesty's Stationery Office, London. Price 6d.

(*Continued on page* 137)

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SELECT FROM THE ONLY COMPLETE LINE

Keeping a variety of water services metered at peak efficiency can be a big task. But it needn't be—with the help of the complete Pittsburgh-Empire line. When in doubt about the best type of meter for any service, rely on the *impartial* advice of your Pittsburgh-Empire representative. He handles *all* the commercial varieties of meters, hence has no axe to grind. These men have second-to-none records for applying the right meter to all types of water measurement jobs.

For unprejudiced guidance, for real measurement engineering service, and for a complete line of meters from which to choose you have only to go to one source—Pittsburgh-Empire. And you can be sure to receive top quality and the best in measurement value from any Pittsburgh-Empire meter you buy.

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New York Pittsburgh San Francisco Seattle Tulsa

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Pittsburgh Arctic Disc Meter

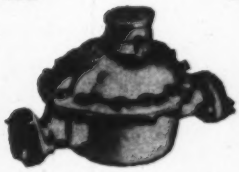
Pittsburgh Tropic Disc Meter

Pittsburgh Imo Meter

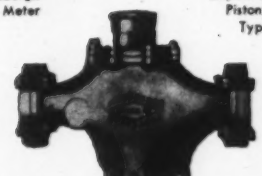
Empire Oscillating Piston Meter Type 12

Empire Oscillating Piston Meter Type 14

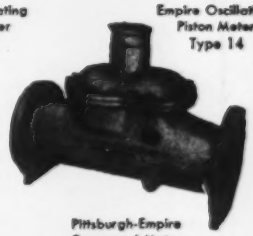
Pittsburgh Disc Meter, Large Capacity Type



Empire Oscillating Piston Meter Type 16



Pittsburgh Eureka "S" Meter, Current Type



Pittsburgh-Empire Compound Meter Single Register Type

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

January Materials and Labor Prices will appear in the January 6, 1949 issue

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash, dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		Ready Mixed 1:2:4, over 50 c.y. del.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand gravel	Lt. wgt. Agg.	
Atlanta	$4.11	$3.36	$3.05	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	4.12	3.37	3.06	2.30*ff*	2.30*ff*	1.95*ff*	2.60*ff*	2.70*ff*	2.45*ff*	2.45*ff*	.16	.16*ee*	9.85
Birmingham	3.80	3.05	....	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.165	.165	7.75
Boston	4.44	3.69	3.40	2.50*t*	2.50*t*	2.50*t*	1.50*t*	1.60*t*	....	....	.17	.185*w*	10.50*m*
Chicago	3.61/3.67	2.86/2.92	2.56/2.62	2.75‡*d*	2.75‡*d*	3.20‡*d*	2.75‡*d*	2.75‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	4.00	3.25	2.94	1.85‡*pp*	1.85‡*pp*	1.75‡*pp*	2.95‡*bb*	2.95‡*bb*	2.30	2.30	.19	.195	10.40*kk*
Cleveland	3.92	3.17	2.82	1.90*llq*	1.65*llq*	1.55*ll*	3.55‡*h*	3.55‡*h*	2.60	2.60	....	.21	11.80*qq*
Dallas	3.57	2.82	2.52	2.00	2.15	1.75	2.10	2.15	....	....	.0775*p*	.285	8.85
Denver	.....	3.59	3.29	1.85	2.00	1.15	....	....	....	....	.20	.23*w*	9.65
Detroit	3.98	3.20	2.92	3.25‡	3.25‡	3.00‡	3.00‡	3.00‡	3.00‡	3.00‡	.17	.18*w*	9.60*kk*
Kansas City	....	....	....	2.05	2.05	1.50/1.80*t*	1.45*q*	1.45*q*	....	....	.17*wf*	....	9.85*m*
Los Angeles	....	3.72*b*	3.34*b*	1.92*t*	2.02*t*	1.72*nn*	1.92*t*	1.92*t*	....	....	.085*oo*	....	10.78*m*
Minneapolis	4.05*dd*	3.30*dd*	3.00*dd*	2.30*h*‡*j*	2.30*h*‡*j*	1.35*h*‡*j*	2.50*h*‡*j*	2.50*h*‡*j*	....	....	.21*cc*	....	10.70*kk*
Montreal	....	2.39*rqq*	2.24*rqq*	1.25*bbs*	1.75*bbs*	....	1.35*cs*	1.60*cs*	....	....	.177*rr*	.1665*wrr*	8.95*s*
New Orleans	....	3.07	2.75	2.32	2.32	1.82	....	....	.90	1.15	.23	....	10.65
New York	....	3.90/4.40‡	....	2.00*de*	2.00*de*	1.45*de*	2.00*ds*	2.00*ds*	....	....	.18*ii*	.18*wccii*	10.30*k*
Philadelphia	4.15‡	3.40‡	3.10‡	2.30‡	2.40‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.18/.22	.18/.22*w*	9.85
Pittsburgh	4.15†	3.38†	3.10†	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.23*z*	.23*z*	11.50
St. Louis	3.80*o*	3.05*o*	2.75*o*	2.60‡*oh*	2.40‡*oh*	2.00/2.40‡*oh*	1.50*c*	1.50*c*	1.10	1.15	.225	.23*yo*	10.40
San Francisco	.....	3.38	2.98	1.84	1.84	1.94	1.94	....	....	....	....	.25*y*	10.75*u*
Seattle	.....	3.45*mm*	2.95*mm*	2.75‡*od*	2.75‡*od*	2.75‡*od*	3.50‡*od*	3.50‡*od*	....	....	.22*o*	....	9.75*u*

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks, Man. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ½ in. *j* 5% discount for cash. *k* 5 cu. yds. or over, del. Man. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* Sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* F.o.b. scow, Hudson River, N. Y. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* Under 5 tons. *cc* 8 x 8 x 18 in., also. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bar. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y. lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete sand. *oo* 4 x 8 x 12 std. wgt. *pp* 5 tons or more. *qq* Dealer's commission not included. *rr* F.o.b. * Prices include dealer's commission except where indicated to the contrary. † Prices not stable.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES AT CEMENT MILLS

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25¢ refund allowed for each returnable bag; for paper bags add 28¢–30¢ per bbl., not refundable.

	Bulk		Bulk		Bulk		Bulk		Bulk
Richard City, Tenn.	$2.40	Buffington, Ind.	$2.20	Steelton, Minn.	$2.40	Muskegon, Mich.	$2.40	Toledo, O.	$2.40
Clinchfield, Ga.	2.40	Independence, Kan.	2.30	Leeds, Ala.	2.25	Saginaw, Mich.	2.35	Milwaukee, Wis.	2.40
Kingsport, Tenn.	2.40	Hannibal, Mo.	2.20	Duluth, Minn.	2.40	Wyandotte, Mich.	2.30	Green Bay, Wis.	2.40
West Des Moines, Iowa	2.30	Northampton, Pa.	2.30	Hudson, N. Y.	2.30	Buffalo, N. Y.	2.40	Ironton, O.	2.25
Nazareth, Pa.	2.30	Universal, Pa.	2.20	Alpena, Mich.	2.25	Oswego, N. Y.	2.40	Montreal City	2.05
Bath, Pa.	2.30	Waco, Tex (+ 9¢ tax)	2.20	Detroit, Mich.	2.40	Cleveland, O.	2.40		

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore	150.00‡	52.70‡	.....	$23.00	.....	$.095	$0.15	$.095*h*	$.17*h*	$.09*s*	$.095	$0.115
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	.....	.....	.....	23.00*o*	3@34.00*o*	.0936*o*	.175*o*	.095*ho*	.185*ho*	.09*o*	.103*o*	.195*o*
Chicago	150.00‡*y*	85.00/88.00*e*‡	3.10/4.15*d*‡	22.50*b*	2.00*b*	21.50*bg*	31.00*bg*	.097/.105*h*	.....	.082/.0845*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	.....	.....	.....	24.50*ff*	.....	.1035	.....	.1035*h*	.....	.....	.....	.....
Cleveland	190.00	49.00*t*	3.87*u*	30.00	40.00	29.50*g*	39.50*g*	.135*h*	.22*h*	.14	.14	.27
Dallas	*l*	40.00	*l*	23.38	42.17	.0987	.1837	26.15	46.65	.0962	.1037	....
Denver	.....	41.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	....	....	.....	28.20	.....	.....	.....	.....	.....	.....	.....	.1873
Kansas City	.....	40.00*g*	.....	20.45*r*	.....	.....	.....	.081*hr*	.....	.071*r*	.....	.....
Los Angeles	*l*	.....	*l*	18.10*mf*	32.60*mfw*	18.10*gm*	32.60*mw*	19.10*m*	26.10*mw*	17.60*gm*	.075*cc*	.145*cc*
Minneapolis	.....	.....	2.79*d*	28.00	37.00	23.00*g*	34.00*g*	27.00	38.00	.105	.13	.23
Montreal	140.00	.....	.....	25.00*k*	34.65*k*	15.70*kp*	19.95*kp*	15.30*kp*	17.30*kp*	14.20*kj*	.174*k*	.215*k*
New Orleans	.....	.....	.....	20.00*a*	.....*s*	20.00*pa*	.....*s*	.095*hadd*	.....*s*	.095	.0975	.16*n*
New York	.....	.....	2.50*d*	26.50	38.86	25.50*g*	44.88*g*	.1090*h*	.1917*h*	.1040	.1090	.1897
Philadelphia	150.00	75.00	4.06	23.00	.....	22.00*g*	.....	.095*h*	.....	.....	.....	.....
Pittsburgh	165.00	42.00	4.50	26.00	39.00	.12	.24	27.00	40.00	.095	.10	.21
St. Louis	.....	.....	.....	21.40	.....	.....	.....	.....	.....	.....	.1025	.....
San Francisco	.....	57.75*c*	.....	18.10*es*	32.60*wee*	18.10*geeff*	.....	20.10*ee*	.....	.....	.0775	.1475
Seattle	.....	.....	.....	17.50*i*	36.75*i*	17.00*ig*	.....	19.50*i*	23.50*aai*	18.00*ig*	.075*i*	.09

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. refinery. *c* 2¼ x 8¼ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40–80 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums, per drum. *k* Tax included. *l* Not used. *m* F.o.b. refinery, El Segundo. *n* 55 gal. drums. *o* Price at plant, in Everett. *p* Per 100 gal. *q* F.o.b. Buffalo. *r* F.o.b. Sugar Creek, Mo. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *u* 3-in. *v* Bulk, refinery. *w* Shipped in steel barrels, no longer in double head wood barrels. *x* Truck deliveries in Detroit $75.00. *y* Carload lots. *aa* In customer's drums. *cc* F.o.b. refinery, Inglewood. *dd* Medium curing. Rapid curing, $.0975; slow curing, $.0925. *ee* F.o.b. Richmond. *ff* 50–300 penetration.

IRON AND STEEL PRODUCTS—PER 100 LBS. BASE MILL PRICES

	STRUCT. SHAPES–PLATE	REINF. BARS billet *ab*	RIVETS ½-in. structural	SHEET PILING Base	STEEL RAILS Per Net Ton Standard*a*	Light *cf*	Re-rolled	TRACK SUPPLIES Angle Bars	Std Spikes	Tie Plates*eg*	Track Bolts *d*
Birmingham Area	$3.25	$3.35	$6.75	....	$64.00	$71.00	Not	$4.25	$5.35	$4.05	....
Chicago Area	3.25	3.35	6.75	$4.05	64.00	71.00	avail-	4.25	5.35	4.05	....
Pittsburgh Area	3.25	3.35	6.75	4.05	64.00	71.00	able	4.25	5.25	4.05	....
Buffalo Area	3.30	3.35	6.75	4.05	64.00	71.00	....	4.25	5.35	4.05	$8.50
Cleveland	....	....	6.75	....	.....	.....	....	....	....	....	8.50
Youngstown Area	....	3.35	....	....	.....	.....	....	....	5.35	....	....
Geneva	3.25	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	....	4.10	....	....	.....	.....	....	....	5.35	....	....
Pueblo	3.25	3.35	....	....	64.00	71.00	....	4.25	5.35	4.05	8.50

a To fabricators. To consumers: $4.25; except $5.00 Seattle, Wash. *b* Rail steel price $4.65; Williamsport, Pa. *c* Rail steel $94 per ton Williamsport, Pa. *d* Treated. Untreated $8.25. *e* Except $70.00 Indiana Harbor, Ind. $85.00 Minnequa, Colo. *f* Except *g* Except $4.20 Pittsburg, Calif.; $4.50 Seattle, Wash.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS*g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add switch	$/cwt for Del.	EXPANDED METAL LATH*k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REFORCING*d* Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires
Atlanta	$4.75	$5.225*k*	$5.225*k*	$.025	$.10	$31.50	$31.50			
Baltimore	5.48	4.47*l*	....	....	.10	40.00	43.00			
Birmingham	5.15	5.15	5.50	.05	.15	43.00*p*	45.50*p*			
Boston	5.54*k*	5.46*k*	5.34*kc*	....	.10/.15	31.00	33.00			
Chicago	5.05	4.20/4.70*ff*	4.20/4.70*ff*	.05	....	31.00‡	33.00‡			
Cincinnati	5.60‡*r*	5.55*r*	....	....	....	33.00*zee*	35.00-*zee*			
Cleveland	5.45*hh*	4.37*v*	....	....	.10	34.50	36.50			
Dallas	6.30	6.25	6.25	....	....	33.75	35.75			
Denver	6.45	6.30*e*	....	....	....	43.00*s*	50.00*qs*			
Detroit	5.25*	....	....	....	.10	33.50*x*	45.00*q*			
Kansas City	6.00	4.75*z*	....	....	....	37.00	39.00			
Los Angeles	5.70*f*	6.10*bb*	....	....	.15	41.00*f*	45.00*kk*			
Minneapolis	5.90‡	6.19*ccn*	6.19*ccn*	....	.15	34.50	36.50			
Montreal	5.25*i*	4.70*i*	4.70*i*	....	....	44.10*h*	46.80*h*			
New Orleans	....	5.00*ok*	....	.05	.10	32.00	32.00			
New York	5.68*r*	6.00	6.25	....	.15/.20	34.50*st*	36.50*st*			
Philadelphia	5.04	5.15	....	....	....	30.00‡	32.00‡			
Pittsburgh	4.40/4.50	4.40/4.50	4.40/4.50	.05	.10	32.50	34.50			
St. Louis	5.39*k*	5.24*c*	5.24*c*	....	....	42.00*aa*	48.00*aa*	F.o.b. Mill: Joliet, Illinois, Donora, Penn., $2.36 Monessen, Penn., $2.40	F.o.b. Mill: Joliet, Illinois, Donora, Penn., $1.63 Monessen, Penn., $1.66	F.o.b. Mill: Joliet, Illinois, Donora, Penn., $2.47 Monessen, Penn., $2.52
San Francisco	5.90*ii*	5.65	....	....	....	36.50	38.50			
Seattle	4.30*e*	5.25*el*	....	....	....	52.00*s*	42.00*s*			

‡ Delivered. *a* Mill prices. *b* 1-5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate and hard grade, new billet. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed. 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1 ¼ in., 1 ½ in. 10¢, ¾ in., ⅞ in. 15¢, ½ in. 20¢, ¼ in. 35¢, ⅛ in. 55¢, ¼ in. $1.30. *v* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* Delivered truck to job. Contractor to do unloading. *bb* Includes 55¢ extra for ¾ in. size. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b cars. *ff* Carload lots. *gg* Including sales tax. *hh* Delivered price is $5.60. *ii* Rolled at Geneva mill. Shapes rolled at Fontana, $6.90. *kk* ¾" ribbed. * Over 10,000 lbs. Sept.-Nov price of $5.45 was for 400—2,000 lbs.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13-44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14-41 12 in.	24 in.
Atlanta	$100.10	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00
Baltimore	104.50	.378	.729	3.105	8.098	147.00	228.00	.80	2.25
Birmingham	93.50	.40	.72	2.84	....	210.00‡	375.00‡	.90	2.50
Boston	107.90	.441*uvx*	.850*5uvx*	3.87*uvy*	10.36*uvy*	173.40	267.60	1.45‡*mg*	3.60‡*mg*
Chicago	106.70	.59	1.14	4.81	13.45	150.00‡	270.00‡	.70	2.35
Cincinnati	105.20	.441	.8505	3.51	9.53	154.80‡	241.20‡	.60	2.25
Cleveland	107.30	.357*z*	.6885*z*	3.015*z*½	8.405*z*½	147.50	231.00	.65	2.50
Dallas	109.08	.365	.684	2.72	6.25	109.00	131.00	.48	1.55
Denver	113.92	.41*dd*	.71*dd*	2.98*dd*	....	.....	.....	.74*dd*	2.50*dd*
Detroit	107.30	.555	1.10	4.20	12.75	195.00‡*m*	303.00‡*m*	.65	2.50
Kansas City	108.42	.418*m*	.76*m*	3.00*m*	.....	121.00*m*§	418.00*m*	.60*l*	2.00*l*
Los Angeles	120.30	.426	.927	4.532	11.298	193.00‡	324.00‡	.72	...
Minneapolis	110.30	.62*mo*	1.12*mo*	4.35*mo*	11.290	.....	.....	1.23*h*	3.50*h*
Montreal	90.00	.73*s*	1.28*s*	4.20*s*	6.80*es*	.60*p*	.48*p*	72.00*jkoo*	218.00*jkhoo*
New Orleans	103.10	.412	.762	3.955	9.15	231.00*bb*	.....	.55	1.95
New York	103.50/108.40	.62	1.14	4.45	12.30	.....	.....	1.00	2.25
Philadelphia	101.30	.54	.99	4.08	10.25	235.00‡	300.00‡	1.25*h*	3.20*h*
Pittsburgh	107.82	.364*m*	.702*m*	2.70*m*	6.625*m*	130.20	197.40	1.05*h*	2.50*g*
St. Louis	104.60	.48	.87	3.42	8.05	.....	.....	1.10*il*	2.25*hl*
San Francisco	120.30	.50*d*	.99*d*	3.96*d*	9.90*d*	188.00*dl*	313.00*dl*	.69	2.85
Seattle	122.10	.51*b*	.91*b*	....	....	150.00*e*	.....	.80	2.40

*WROUGHT STEEL PIPE (Full standard weight)

Mill	2½ & 3 in. Butt Weld† Black %	2½ & 3 in. Butt Weld† Galv. %	3½ to 6 in. Lap Weld† Black %	3½ to 6 in. Lap Weld† Galv. %	8 in. Black %	8 in. Galv. %	10 in. Black %	10 in. Galv. %
Lorain, Pa.	50.5	32.0	...	...	...	...	...	...
Aliquippa, Pa.	49.5	30.0	46.5*a*	26.5	...	...	...	...
Sparrows Pt., Md.	48.5	27.0	42.5	20.5	...	...	...	...
Benwood, W. Va.*	50.5	31.5	44.5	25	...	...	...	...
Youngstown, O.	50.5	31.5	...	...	...	...	...	...
Indiana Harbor, Ind.	49.5	30.5	42.5	23	...	...	...	...
Sharon, Pa.	48	29	46.5*a*	26.5*a*	...	...	...	...
Wheatland, Pa.	49.5	30.0	44.5	22.5	...	...	...	...
Etna, Pa.	50.5*b*	29.0*f*	42.5	17.5*ab*	...	...	...	...
Fontana, Calif.	19.5*b*	0.0*b*	12.5*ab*	...	...	...	...	...

a 3½ to 4 in. *b* Continuous †Threaded and coupled. * Proces being revised.

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, N. J. (base) $98.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200-44T. *c* 4-in., $90. *d* SS36‡-A. *e* 30 in. *g* Culvert pipe Reinforced, ASTM C76-41. *h* Reinforced. ASTM C75-41. *i* Reinforced. ASTM C76-37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city. *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A 60-1941 specifications used. *aa* No standard specifications in Can. *bb* Freight allowed to destination in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck.

* WROUGHT STEEL PIPE: Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: *Butt Weld:* ¼ in., 5½¢; ⅜ in., 6¢; ½ in., 6¢; ¾ in., 8½¢; ¾ in., 11½¢; 1 in., 17¢; 1¼ in., 22¢; 1½ in., 27½¢; 2 in., 37¢; 2½ in., 58½¢.; 3 in., 76½¢. *Lap weld:* 3½ in., 92¢; 4 in., $1.09; 5 in., $1.48; 6 in., $1.92. Freight rates to destination to be added to price, plus 3 percent tax on transportation.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. *Butt weld* — 1 in. and 1¼ in. black, +4.5, galv. +32.5; 1½ in. black, 1.5, galv. +29.0; 2 in. black 2, galv. +28.5. *Lap weld* — 2½ in. to 3½ in. black + 5, galv. +32.0; 44 in. to 8 in. black + 2, galv. +27.5. Freight rates to destination to be added to name delivered price.

IMPACT WRENCHES	bolts up to 1 3/4"
RIVETERS	rivets up to 1 1/4"
DRILLS	up to 5"
REAMERS	up to 2 1/2"
TAPPERS	up to 2 1/2"
TUBE ROLLERS	up to 6"
AIR HOISTS	up to 20,000 lbs.
DIGGERS	hard pan, clay, gravel, etc.
SCALING HAMMERS	rust, scale, paint, etc.
CONCRETE VIBRATORS	strong, uniform concrete
SUMP PUMPS	up to 250 gpm
TAMPERS	for firm backfill
WIRE BRUSHES	up to 10"
CHIPPING HAMMERS	light, medium or heavy chipping
AIRLITE	150 watt air power generator

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LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

		SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)								LONG LEAF Y. P. Merchantable grade		PLYWOOD Rail freight increment (See note for base price)	
		All Fir planks No. 2 common. Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)								up to 20 ft.			
		1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	5/16"	3/4"
Atlanta	l	**$70.00**	**$71.00**	**$60.00**	**$62.00**	**$65.00**	**$68.00**	**$70.00**					**$22.32**	**$27.24**
Baltimore		**90.00**	**95.00**	**92.00**	**95.00**	**95.00**	**98.00**	**115.00**			175.00	175.00	22.86	27.90
		120.00	*120.00*	*115.00*	*115.00*	*115.00*	*115.00*	*125.00*	*125.00*	*125.00*				
Birmingham	l	**87.50**	**90.50**	**75.00**	**78.00**	**80.00**	**82.50**	**105.00**			130.00	125.00	21.78	26.58
	l	*80.00*	*80.00*	*75.00*	*75.00*	*75.00*	*75.00*	*85.00*	*85.00*	*85.00*				
Boston		80.00[3]	80.85[3]	85.00[3]	85.00[3]	85.00[3]	90.00[3]	100.00[3]					22.86	27.90
		95.00	*95.00*	*97.00*	*80.00*	*80.00*	*100.00*	*100.00*	*100.00*	*100.00*	100.00	100.00		
Chicago	‡	**87.00**	**92.00**	**80.00**	**82.00**	**84.00**	**90.00**	**97.00**			117.00	117.00	18.72	22.80
	‡	*95.00*	*100.00*	*92.00*	*92.00*	*92.00*	*92.00*	*97.00*	*97.00*	*97.00*				
Cincinnati		**100.00**	**108.00**	**105.00**	**105.00**	**108.00**	**115.00**				150.00	150.00	21.78	26.58
Cleveland		**80.81**	**81.84**	**72.74**	**80.00**	**81.00**	**84.00**						22.20	27.12
Dallas	l	**71.00**	**71.00**	**61.00**	**59.00**	**61.00**	**66.00**	**80.00**			72.00	80.00	18.72	22.80
Denver		*101.00*	*101.00*	*110.00*	*109.00*	*108.00*	*109.00*	*105.00*	*125.00*	*129.00*			13.92	16.98
Detroit		**81.50**	**85.50**	**73.00**	**81.00**	**81.00**	**90.00**						21.78	26.58
		86.00	*86.00*	*85.00*	*85.00*	*85.00*	*85.00*							
Kansas City	b	**110.00**	**110.00**	**100/103**	**100/103**	**105.00**	**105.00**				105.00	105.00	16.56	20.16
	b	*115.00*	*115.00*	*105/108*	*105/108*	*110.00*	*110.00*	*120/125*	*135.00*	*135.00*				
Los Angeles	a	*94.00*	*94.00*	*88.00*	*88.00*	*88.00*	*88.00*	*98.00*	*105.00*	*95.00*			13.38*gh*	16.26*gh*
Minneapolis	b	*111.00*	*111.00*	*111.00*	*111.00*	*111.00*	*113.00*						16.56	20.16
Montreal	e	75.00	76.00	75.00	75.00	76.00	85.00							
		155.00	*155.00*	*155.00*	*155.00*	*155.00*	*155.00*		*130.00*					
New Orleans	l			**70.00**	**75.00**	**75.00**	**70.00**	*85.00*			100.00	105.00	18.72	22.80
	l	*68.70*	*68.70*	*71.00*	*75.00*	*72.50*	*72.50*	*67.00*	*67.00*	*67.00*				
New York	‡	**90/95**	**95/100**	**Range from $80.00 to $90.00**				**100/105**			175/200†	175/200†	22.86	27.90
	‡			*Range from $97.50 to $105.00*					*115/120*	*115/120*				
Philadelphia				**Range from $95.00 to $104.50**							171.00	171.00	22.86	27.90
				Range from $110.00 to $120.00				*110/120*	*127.00*	*127.00*				
Pittsburgh	l	**78.00**	**79.00**	**82.50**	**82.50**	**87.50**	**87.50**	**110.00**					22.56	27.48
	i	*103.60*	*103.60*	*105.00*	*110.00*	*105.00*		*120.00*	*150.00*	*165.00*				
St. Louis	‡j	**95.00**	**98.50**	**87.50***m*	**92.50***m*	**99.50***m*	**107.00***m*						18.72	22.80
	‡j			*115.00n*	*115.00n*	*115.00n*	*115.00n*							
San Francisco	d	*73.00*	*73.00*	*73.00*	*71.00*	*71.00*	*70.00*	*70.00*	*70.00*	*70.00*			10.08*g*	12.30*g*
Seattle	l	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*75.00i*	*75.00i*	*75.00i*				

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [3] Spruce. [4] Western Pine No. 3 Common. ‡ Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Direct mill prices; f.o.b. purchasers carrier or truck. *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truck load in Greater Cleveland. Less 2% for cash. Truck lots. *l* F.o.b. mill. *m* 8 to 12 ft. lengths. *n* 8 to 16 ft. lengths.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ⅜", $188.00; on ½", $218.00. For other centers add rail freight increment from table on proper size. Oiling and edge sealing charges included.

† 18 ft. and under.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946*a* Single or Double Thickness A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
Atlanta	76%	76%	$0.2025
Baltimore	70–10%	71–10%	.2025
Birmingham	68%	68%	.1575
Boston	.....	60%*i*	.2025
Chicago	64%	64%	.2025
Cincinnati	62–10%*e*	62–10%*e*	.2025
Cleveland	62–10–10–10%	62–10–10–10%	.2425
Dallas	65%	65%	.215
Denver	66%	66%	.2075
Detroit	62–10–10%	62–10–10%	.2025
Kansas City	65–10%*e*	65–10%*e*	.2075
Los Angeles	58%	63%*f*	.21
Minneapolis	64%	64%	.2075
Montreal	40–5%*bc*	40–10–5%*bc*	18.90*h*
New Orleans	68%	68%	.2125
New York	71%	72%	.32*g*
Philadelphia	69%	70%	.2025
Pittsburgh	70%	70%	.175
St. Louis	70–10%	70–10%	.2075
San Francisco	66%	73%	.2075
Seattle	54%	55%	.21

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

Glass; *a* Jobbers' list price per box, 14 x 20, ss, $20.75 for A quality, $18.00 for B quality; 14 x 20, ds, $30.75 for A quality, $26.00 for B quality. *b* Discount from list, Sept. 1939; sales tax included, but 6% tax exemption not allowable for. *c* Single thickness. *e* Discount from list of Aug. 15, 1938. *f* ss; ds—62%. *i* Double thickness 65%.

Explosives; * Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. *g* In borough of Kings, Queens, and Richmond and in Manhattan south of Canal St., add delivery charge of $9.00 per trip. *h* F.o.b. city per 100 lb. forcite, 40%. Forcite 60%, $20.65.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.155	$0.1825	$0.2025
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.16 –.1675	.1875–.20	.2075–.22
Rocky Mtn. States	.16 –.1725	.1875–.20	.2075–.225
Pacific N. W. States	.1575–.17	.19 –.2025	.21 –.2225
Pacific S. W. States	.155 –.1625	.1875–.195	.2075–.2175

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.37	....
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.39	....
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.72
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.73
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.43	.80
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.47	.74
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.60	.75
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	....	.76
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.80

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak*i*	....	....	....	....
	Pine*i*	....	....	....	....
New York	S. L. Sap Pine	$1.65	$2.85	$2.00	$3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.55/2.60*a*	....	.25/3.40*a*
Los Angeles	Douglas Fir	....	3.00*a*	....	....
Philadelphia	Red Oak	2.33	3.13	3.10	4.25*a*
St. Louis	White Oak	2.40	....	3.07	....
	Red Oak	2.29	2.95*a*	2.97	3.90*a*
	Sap Pine or Cypress	3.07*a*	....	....	....
San Francisco	Douglas Fir	1.60*e*	2.80*f*	2.10*bf*	3.88*eaf*
Montreal	Birch or Maple	....*h*	....*h*	....*h*	....*h*

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars. *h* No constant price available. *i* Not available

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$4.25
Chlorine cylinders, liquid, per lb. f.o.b. works	.07–.12
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, f.o.b. works, ton	22.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.80
Soda ash, 58%, in paper bags, per 100 lb. dense	1.50
Sulphate of aluminum, commercial, in 100-lb. bags f.o.b. works	1.50
Sulphate of copper, in bags, per 100 lb f.o.b. works	8.10

...high octane gasoline

...electric household appliances

partners in creating

• Creative men...engineers and engineering draftsmen...plan and build things to last. By the same token they look for instruments and equipment that will last. The tracing paper they draw on must be permanent. Their drawings must serve as lasting records. They may even have to use these same drawings years later to make new reproductions.

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EST. 1867

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LOS ANGELES • MONTREAL

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity Common backing	Straight hard	LIME Per ton, In paper, Carload lot, Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$25.00	$25.00	$19.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	32.00*k*	35.00*k*	30.18	18.00	...
Birmingham	97.50	104.00	195.00	231.00	.....	.....	20.00*ff*	22.50*ii*	24.67	18.10	.....
Boston	145.65†	155.35†	291.30†	330.15†	.....	.....	32.00*i*	35.00*i*	30.80†	26.40†	.....
Chicago	115.00	122.50	230.00	.....	.....	.....	21.00	23.00	27.00	19.50	.....
Cincinnati	170.00*j*	180.00*j*	240.00*jdd*	.....	.....	.....	34.00*j*	34.00*j*	21.40*j*	19.70*j*	.....
Cleveland	118.00*cc*	126.00*cc*	236.00*cc*	.....	.....	.....	28.50	28.50	24.00	22.00	27.50*ee*
Dallas	.....	110.00	.....	.....	.....	.....	18.75	33.25	28.00	22.00	.....
Denver	.....	.....	.....	.....	.....	.....	30.00	30.00	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	117.08	124.88	234.15	234.15	290.68	332.20	30.00*cc*	31.50*cc*	30.00	28.00	28.00
Kansas City	112.00	120.00	... ..	.....	.....	.....	16.00*o*	18.50*o*	36.00*p*	30.00*p*	30.00*p*
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	20.00§	.....	.....	36.00	35.00
Minneapolis	152.00*p*	176.00*p*	317.00*p*	176.00*wp*	.....	.....	30.00*wp*	.....	34.50*hhe*	25.50*hhe*	34.50*hhdd*
Montreal	110.00*aq*	120.00*aq*	225.00*aq*	.....	.....	.....	25.50	37.00	12.50*uh*	14.00*uh*	.....
New Orleans	160.00	160.00	300.00	.....	.....	.....	29.00	.....	38.00	26.00	37.50
New York	112.20*h*	119.60*h*	164.50*h*	179.40*hn*	.....	.....	33.00	...	34.40	26.80	...
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	27.00	30.00	29.75	17.50	24.50
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.60	26.00	38.00*y*	20.45	18.65	2.97*m*
St. Louis	126.00	138.50	252.50	252.50	339.50	.....	32.50*al*	30.50*al*	80*aap*	60*aap*	1.00*aapee*
San Francisco	132.00*a*	148.50*a*	198.00*dda*	148.50*ta*	.....	.....	30.00	.....	24.95	24.95	2.49*m*
Seattle	150.00*cc*	160.00*cc*	.....	160.00*ccw*	.....	.....	32.00	39.00	32.00*hhh*	32.00*hhh*	3.60*mhh*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *g* 5½ x 8 x 12. *h* F.o.b.trucks, job site N.Y.C. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7¾ x 7¾ x 12. Speed tile. *o* F.o.b. Buffalo. *p* Truck lots. *q* Provincial and Municipal tax extra. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. *hh* LCL. § F.o.b. plant.

PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85-90 lb per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$25.60	$33.125	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	25.35	32.75	2.25	3.50	2.75	2.75	3.30	3.30	.55	36.00
Birmingham	25.60	33.125	4.40	4.52	....	3.05	3.00	3.00	.48	42.00*ss*
Boston	25.35	32.75	....	.. ..	....	....	....	2.75‡*q*	....	34.00
Chicago	25.35	32.75	....	....	....	2.82‡*u*	2.87‡*o*	2.87‡*o*	35.00‡*bbs*	38.00‡
Cincinnati	25.35	32.75	....	....	....	2.44‡	2.54‡	2.54‡	.35*y*‡	42.00‡
Cleveland	25.35	32.75	3.00	3.00*s*	3.00	2.44	2.54*o*	2.54*o*	.32*y*	38.00
Dallas	25.35	32.75	....	4.05	....	3.50*q*	3.75*q*	4.35*q*	.30	45.00
Denver	25.35	33.25	2.88	4.38	2.63	3.17*o*	3.10*o*	.....	.41*ff*	48.00
Detroit	25.35	32.75	3.24	2.72	3.60	2.32	2.41	2.41	....	35.00
Kansas City	25.35	32.875	...	....	...	3.65	3.80	. ..	.50	.....
Los Angeles	25.60	33.25	2.80	4.00	3.50	2.32	1.77*e*	*l*	65	*l*
Minneapolis	25.35	31.625*m*	....	....	....	2.42*idd*	2.47*hidd*	2.47*hidd*	.42*idd*	35.00*rdd*
Montreal	.....	23.65	3.25*p*	4.20*p*	3.62*p*	3.45*t*	3.15*tf*	2.65*tf*	...	2.60*kt*
New York	25.35	32.75	3.45*y*	....	3.45*y*	2.32	2.41*o*	2.41*o*	.34*s*	35.00
Philadelphia	25.35	32.75	3.25	3.65	3.15	2.54	2.94	2.94	.37	26.00
Pittsburgh	25.35	32.75	2.00	2.40	1.90	3.00	3.10*o*	3.10*o*	.37	40.00
St. Louis	25.35	32.75	....	....	....	2.48	2.54*h*	2.54*h*	.36	36.00
San Francisco	25.60	33.00	1.80	2.75*n*	1.35	2.27*x*	3.30*nn*	....	.38*y*	.....
Seattle	25.60	33.25	2.95*m*	2.95*m*	....	3.25*mqcc*	3.35*hmcc*	....	.49*mcc*	58.58*jmcc*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll. 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *u* Per 90 lb. square. *v* Per ton. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* Roofers coating and cement. Price per ton. *cc* LCL, truck delivery. *dd* 2% cash discount. *ee* Asphalt, in 100 lb. package. *ff* 5-gal. drums.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Electrical Workers	Steamfitters	Common Labor — Building	Common Labor — Heavy Const.
Atlanta	$2.50	$1.775	$2.00	$2.00	$2.00	$2.00	$2.00	$0.85	$0.95
Baltimore	3.00	2.25	2.40	2.20/2.40	2.25	2.25	2.25	1.25	1.25
Birmingham	2.25	1.80	2.15	1.75/2.25	2.20	2.00	2.25	.95	1.05
Boston	2.50	2.10	2.40	2.45	2.50	2.30	2.30	1.55	1.55
Chicago	2.40	2.35	2.40	2.35	2.40	2.35	2.35	1.70	1.70
Cincinnati	2.50	2.20	2.35	2.50	2.375	2.375	2.35	1.46	1.46
Cleveland	2.375	2.325	2.375	2.25	2.375	2.375	2.375	1.725	1.725
Dallas	2.50	2.25	2.25	2.25	2.125	2.00	2.375	1.075	1.275
Denver	2.25*b*	2.10	2.00*b*	2.15*b*	2.25	2.25	2.24	1.40	1.35
Detroit	2.50	2.20	2.40	2.40	2.50	2.40	2.40	1.575	1.575
Kansas City	2.50	2.05	2.20	2.05/2.275	2.50	2.30	2.375	1.475	1.40
Los Angeles	2.625	2.0375	2.30	1.9875	2.50	2.40	2.50	1.4875	1.4875
Minneapolis	2.25	2.05	2.175	2.00	2.35	2.21	2.25	1.45	1.45
New Orleans	2.05	1.875	2.00	1.625/1.875	1.875	2.00	2.25	90	90
New York	3.20*b*	2.75*b*	3.00	3.00	3.20*a*	2.50*a*	2.75*b*	1.70	1.70
Philadelphia	2.75	2.25	2.65	2.50	2.50	2.375	2.50	1.25	1.25
Pittsburgh	3.00	2.50	2.50	2.65	2.625	2.375	2.50	1.50	1.50
St. Louis	2.75	2.45	2.425	2.55	2.50	2.50	2.50	1.50	1.75
San Francisco	2.8125	2.16	2.40	2.125	2.25	2.50	2.375	1.525	1.525
Seattle	2.365	2.065	2.265	2.20	2.365	2.265	2.50	1.665	1.70
Montreal*	1.40	1.25	1.30	1.20	1.40	1.35	1.11	94	.88

a 6 hr. day. *b* 7 hr. day. * Cost of living bonus now included in basic wage.

MEXICO CITY PRICES

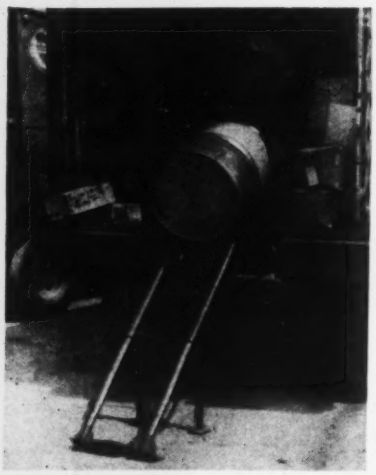
In Pesos, F.o.b. City		Sept. '48	Oct. '48
Common Wages—Building (8 hr. day)	av. per hr.	.57	.57
Common Wages—Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes 3"-15" x 12 meters	per ton	1,300.00	1,300.00
Reinf. Steel, Corr. Rods ⅜" x 12 meters	per ton	1,140.00	1,140.00
½" x 12 meters	per ton	1,080.00	1,080.00
⅝" x 12 meters	per ton	1,056.00	1,056.00
¾" x 12 meters	per ton	1,020.00	1,020.00
⅞" x 12 meters	per ton	1,020.00	1,020.00
1" x 12 meters	per ton	1,020.00	1,020.00
Gravel truck load of 3½ cu. meters			
Blue Gravel	per tr. load	32.00	32.00
Rose Gravel	per tr. load	30.00	30.00
Cement, Std. Port. (Tolteca)	per ton	115.00	115.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	350.00	350.00
1st Class Pine	per M ft.	650.00	600.00
2nd Class Pine	per M ft.	500.00	500.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.347. **ENR Common Average:** $1.413

NEW PRODUCTS

Rear Dump Rock Wagon

The "Tournarocker" is a new rear dump rock wagon designed to be loaded by shovel or dragline. It has a struck capacity of 16.5 yd. or 16 tons. Its wide top opening and low body, only 6½ ft. high, permit easy spotting at shovel. Stability is assured by low center of gravity. Tournarocker can turn around in a 12½-ft. radius. Dumping is done by locking brakes on rear wheels at edge of dump and raising the bowl by an electric motor and cable attached to bottom rear of bowl.—R. G. LeTourneau, Inc., Peoria, Ill.



Unloading Device

A combined ladder and extensible unloading ramp for trucks and trailers is offered. It is made of cold drawn seamless steel tubing and weighs 120 lb., its capacity being one ton. It is a permanent part of the vehicle. Easy to install and no complicated parts to get out of order. When not used for unloading it hangs folded up in a vertical position on rear of truck, making a convenient ladder.—Marion Ramp Co., 508 Oak St., Marion, Ohio.

Aggregate Bin

Available for use with one or two Hi-Speed multiple material batchers, the low, 11-ft. wide aggregate bin has 50 deg. bottom slopes. The 120 and 125-cu. yd. sizes ship in only two main sections and smaller sizes in one piece, enabling fast erection. Steel-frame mat assemblies eliminate the need for concrete footings on temporary set-ups, and the bin converts into a low-cost ready-mix plant with the substitution of long leg and cement roof sections and substitution of a truck-mixer weigh hopper.—C. S. Johnson Co., Champaign, Ill.

Welding and Cutting Torch

—With a flexible head that can be revolved through a 180-deg. arc, the Cristorch reaches previously inaccessible spots. The torch will cut metal of 1/32 to 4-in. thickness and holes and circles from ⅜ to 30-in. dia with 1/64-in. accuracy. It cuts countersunk holes and bevels one or both sides of a straight cut in a single operation. It is equipped with a side-opening tip lock-nut which decreases time required for the tip-changing operation.—Hamilton Tool Co., 9th St., at Hanover, Hamilton, Ohio.

Air-Powered Drill Jumbo

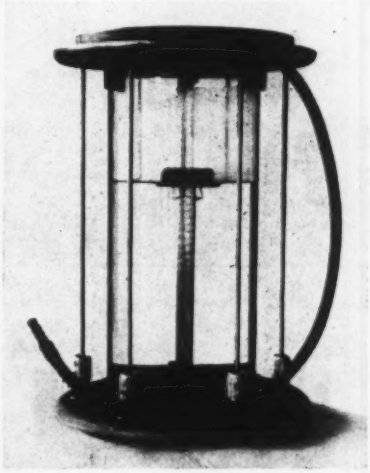
The Boom-Jumbo features air-powered booms of light, rigid construction which can be raised or lowered at the touch of a lever. Air motors insure a positive screwdrive, and booms are locked in position during operation. The drill jumbo can work in an opening 9 ft. high and 5 to 14-ft. wide. Controls are located on the front end of the booms for the operator's convenience. Three screw-driven, adjustable-length ceiling jacks mounted on the car hold it in place during drilling.—Ingersoll-Rand Co., Phillipsburg, N. J.

High-Tower Scaffolding

Tubular steel construction permits adjustability and flexibility and requires less material in erecting high-tower scaffolding. Any desired height is attained with rigidity and safety. Joints are electrically welded.—Bil-Jax Inc., Archbold, Ohio.

New Type Vibrator Shaft

This new shaft has the reinforcing spring of the flexible shaft completely locked in by being solidly embedded in a heavy layer of oil-resistant molded rubber. This provides a strongly reinforced shaft perfectly smooth on the outside and makes for long shaft life. Another feature is a non-metallic anti-friction inner liner impregnated with graphite. —Wyzenbeek & Staff, Inc., 838 W. Hubbard, Chicago 22, Ill.

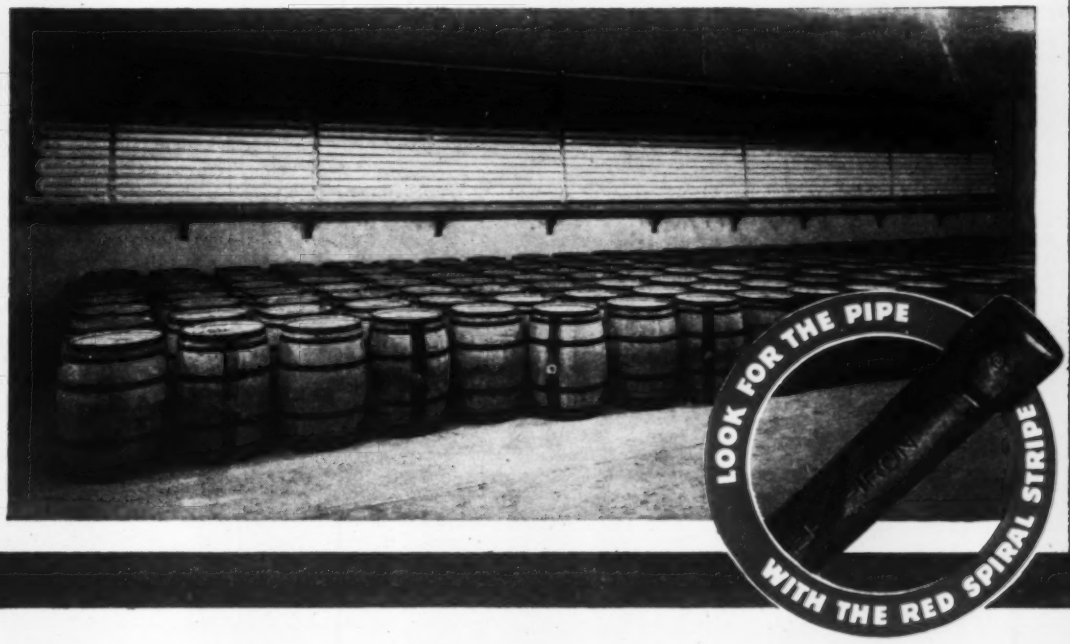


Density Volumeter

Water from Volumeter fills rubber balloon in hole from which earth density sample has been taken. Balloon assumes shape of hole, so volume of transferred water is hole volume. Differential reading of float indicator on calibrated scale gives volume of transferred water.—Rainhart Co., 602 West 34th St., Austin, Tex.

COMBATING CORROSION and MAINTENANCE HERE

BYERS WROUGHT IRON PIPE



The cold storage room pictured is the first of a new group of ten to be constructed by the Kern Ice and Cold Storage Company of Bakersfield, California in a big expansion program. The aim is to increase facilities for handling perishable and processed fruits and vegetables; ten similar rooms have previously been completed. This 41′ x 60′ room, in which condensed milk is stored, is chilled by two banks of ammonia coils, fabricated from Byers Wrought Iron 2-inch pipe. The pipe was gas-welded, and when tested was 100 per cent free from leaks.

CERTIFIED BY SERVICE RECORDS

Wrought iron is a favored material for this service, and the record tells why. In Pennsylvania, a user reported wrought iron coils still serving and in good condition after 37 years; in Washington, a cold storage company inspected wrought iron coils 41-years old, and found them in excellent condition; in Kentucky, wrought iron coils were still on the job, and still good, after more than 45 years of use. These are only a few of many such examples.

WHY WROUGHT IRON ENDURES

The reason for wrought iron's exceptional performance is found in its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting and local penetration. The fibers also help anchor the initial protective scale, which shields the underlying metal.

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You will find some profitable tips on reducing maintenance in our bulletin, "Wrought Iron in Refrigeration and Air Conditioning Systems". May we send you a complimentary copy?

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True case history: Rubber equipment users regularly get replacement parts by Air Express so machines won't stand idle. Recent shipment: 102-lb. carton picked up 5 P.M. the 18th in Noblesville, Ind. Air-rail to Dallas, delivered 9 A.M. following day. 799 miles, total cost only $26.78. Any distance inexpensive, too. Phone local Air Express Division, Railway Express Agency, for fast shipping action.

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Pistol-grip Electric Drill

Light weight and reserve power are featured in a new addition to the line of "Hole-Shooters". It is a pistol-grip type of electric drill. Motor brushes and commutator are accessible by simply removing an inspection plate. Equipped with AC or DC universal type motors for standard 115-volt current. Jacobs chucks are standard equipment. Tool housings are streamlined and cast from high-grade aluminum. Average net weight is only 3½ lb.—MILWAUKEE ELECTRIC TOOL CORP., MILWAUKEE, WIS.

Bubbler Meter

Gas or liquid purge rates are measured in familiar flow units (i.e. cubic feet per hour of air or gallons per hour of water) by a new purge service flowmeter. The "Bubbler type" purge meter is an adaptation of the FLOW-RATOR instrument that includes a built-in needle valve for close control of purge rates. It covers the range of measurement generally accepted as standard for bubbler installations. The unit consists simply of a Pyrex or stainless steel ball-shaped float, a precision-bore Pyrex metering tube and a die-cast body which houses the needle-type control valve. It is used with liquid level, fluid flow and specific gravity measuring instruments. — FISCHER & PORTER CO., Hatboro, Pa.

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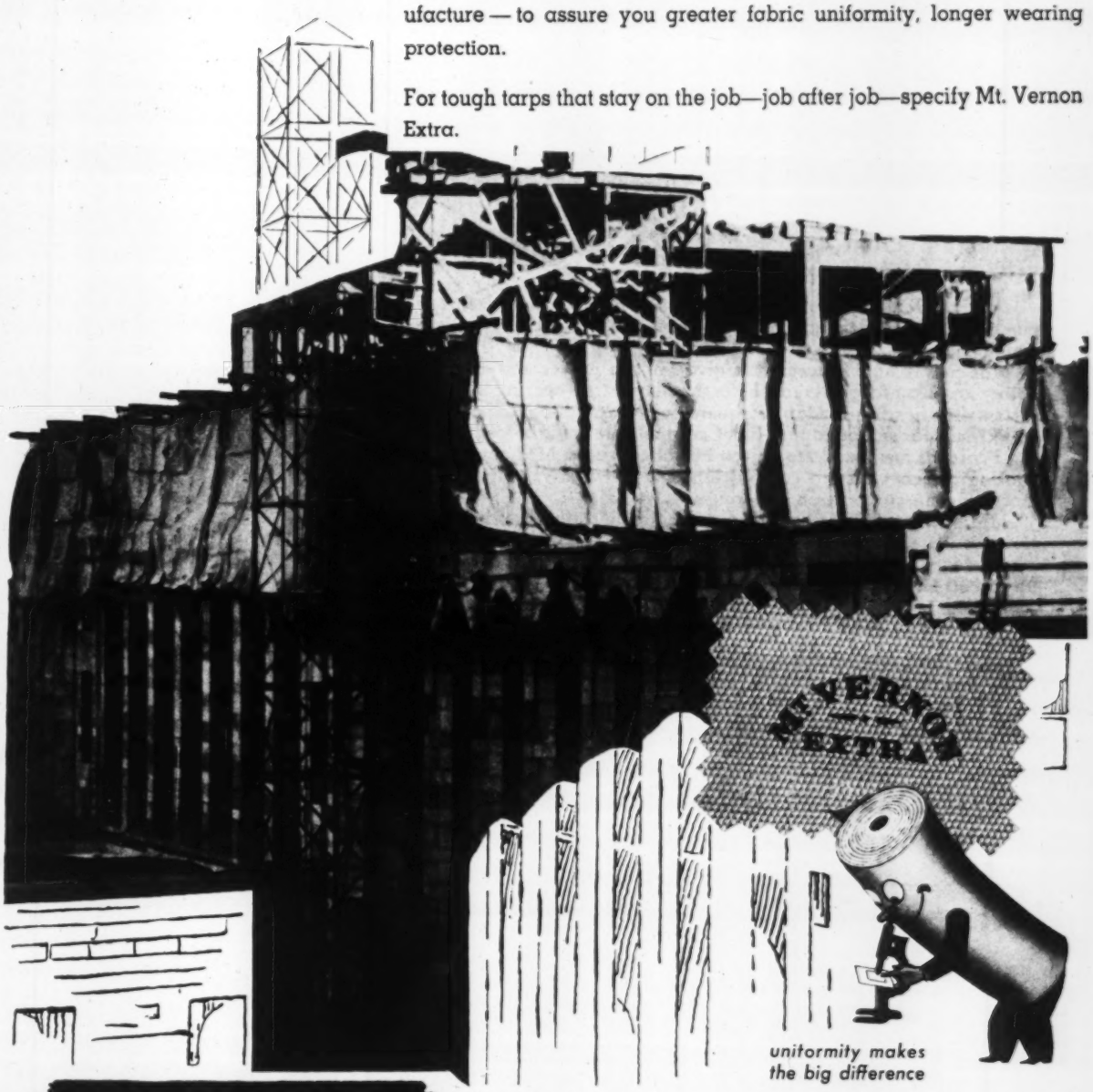

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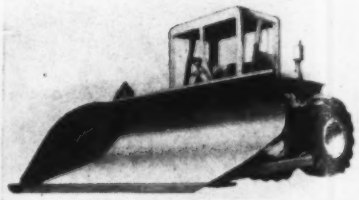

Snow Plow

New V-type snow plow is designed for use with LeTourneau Model C Tournadozer. Moldboards are shaped like a soil plow. In operation snow is lifted from ground and flows with minimum resistance and without packing off the ends of the moldboards. Cable-operated controls permit raising plow 5½ ft. to handle high bank jobs. Width at cutting edges of moldboard is 12 ft. 3 in. Moldboard can be raised 5 ft. 6 in. Weight (with Tournadozer) is 32,200 lb. A special advantage of this piece of equipment is that when snow removal season is over, rig can be quickly transformed to earth-moving tool by replacing snow plow with dozer blade.—R. G. LeTourneau, Inc., Peoria, Ill.

Mechanical Concrete Key

A new device invented by R. Maxwell James of the architectural firm of Green, James & Meadows, Buffalo, N. Y., makes possible the anchoring of plaster directly in concrete. Hitherto contractors have had to erect steel hangers, channels and metal lath under a concrete ceiling before plaster would stick. The new device called Kif is a small elastic knob made of rubbery plastic. They are nailed or bolted about 6 in. apart to the wooden forms used for poured concrete. When they are taken away the Kifs come with them leaving little niches in the concrete into which later the plaster coat flows and hardens.—Key Forms, Inc., 65 Brantwood Road, Buffalo 21, N. Y.

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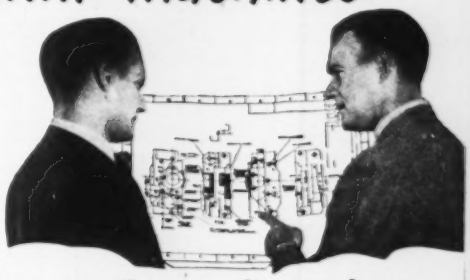

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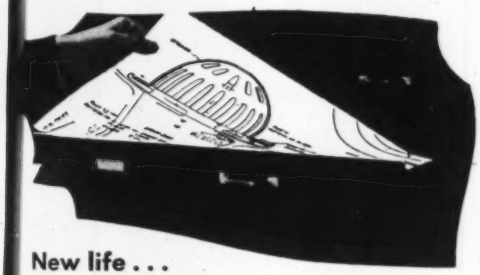

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Manufacturers' Publications

Expansion Joint Fillers—A circular tells of means to counteract the destructive forces of expansion in concrete structures due to temperature changes. It is a preformed bituminous expansion joint which consists of 75 to 80 percent pure blown petroleum asphalt held together in a tough, shock-resistant mass with a fiber binder, further supported by two surface layers of saturated felt paper, giving it added strength and rigidity for handling.—*W. R. Meadows, Inc., Elgin, Ill.*

Stud Welding Process—A poster type broadside describes the many construction applications and cost-saving advantages of the stud welding process of end welding stud-like fasteners to steel surfaces in such work as roofing and siding, sprinkler and piping systems, conduit and wireways, rigid insulation, furring or nailing strips, and heavy decking and planking.—*Nelson Stud Welding, Division of Morton Gregory Corp., Toledo Ave., and E. 28th St., Lorain, Ohio*

Vermiculite Insulation—A folder tells of new methods of construction made possible by the development of vermiculite lightweight aggregates. It covers insulating fill, concrete and plaster, and acoustical plastic.—*Zonolite Co., 135 So. LaSalle St., Chicago, Ill.*

Pneumatic Grouter — Bulletin describes a simple machine for placing low-pressure grout in tunnels, shafts and foundations. The machine has a door which swings out of the way when charging. The bulletin contains a page article on grouting in general covering such points as its use in dam foundations, shafts, tunnels before lining, back of logging in rock tunnels, back of liner plates in soft ground tunnels, in shield driven tunnels, back of concrete lining, railroad sub-graders; and other uses.—*Robert S. Mayo, Lancaster, Pa.*

Steel Buildings—There is a 32-page catalog on Ideco steel buildings outlining the many types and applications of buildings that can be assembled and erected easily from standardized, mass-produced special deep ribbed parts. The principal structural types are self-supporting, rigid frame and mill type. —*International Derrick and Equipment Co., 6315 Pacific, Dallas, Tex.*

General Purpose Pumps—A 6-page illustrated booklet contains descriptions

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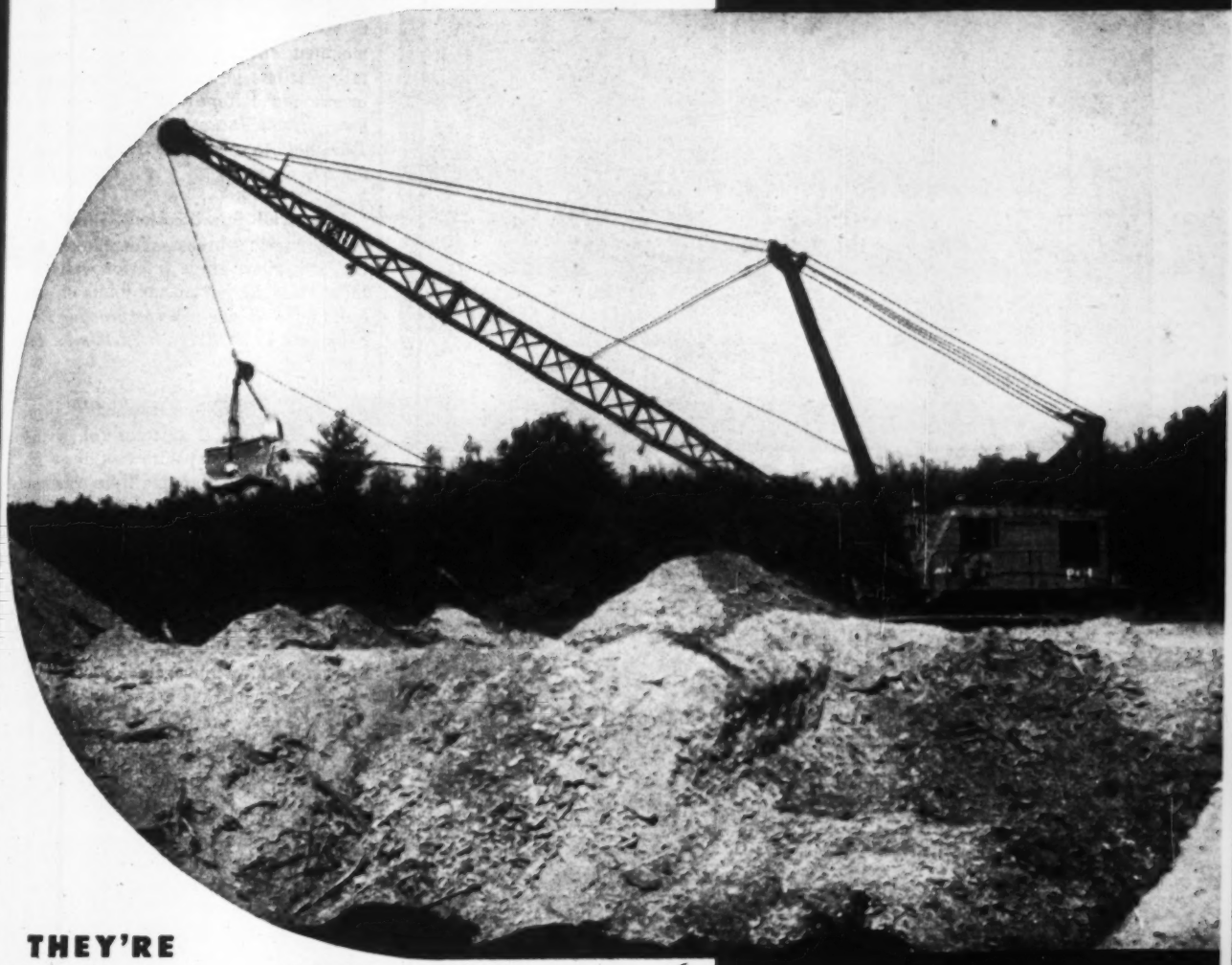

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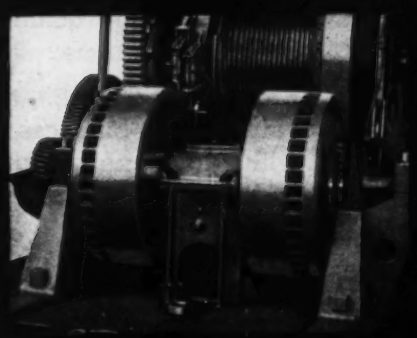

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Dry Wall Specification—Illustrated folder describes processs for waterproofing both above-grade interior wall surfaces and exterior mortar joints of new buildings.—*Western Waterproofing Co., Syndicate Trust Bldg., St. Louis 1, Mo.*

Industrial Dust Control—A bulletin of 24 pages outlines the basic principles of industrial dust control, giving dimensions and capacities of dust filters, which are like multiple vacuum cleaners. More than 100 different kinds of dusts collected are listed. Typical installations are illustrated.—*The W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland 2, Ohio.*

Concrete Testing Machine—Bulletin of 4 pages, gives illustrated descriptions of two cement and concrete testing machines of 90,000 and 300,000 lb. capacities. They were designed primarily to make the tests required by A.S.T.M. specifications. The bulletin describes construction and operation, the weighing and indicating systems, accessories and applications, and includes specifications.—*Baldwin Locomotive Works, Testing Equipment Department, Philadelphia 42, Pa.*

Housing America—That is the title of a recently published booklet on mass housing which emphasizes the necessity of adequate utility service planning in housing developments, and directs attention to centralized community heating as one of the essential utility services. The factors of fuel availability and costs are treated. A study of a community development of 15,900 homes includes a detailed engineering analysis of the recommended central heating system, comparing its cost with corresponding costs of individual home heating units. An informative appendix is a resume of some twelve major housing developments and their heating systems.—*The Ric-Wil Co., Cleveland, Ohio.*

Steel Pipe and Piling—A 4-page composite folder describes pipe, steel sheet piling, rails and track accessories. Separate folders are listed on each product for more specific information.—*L. B. Foster Co., Electric Bldg., Houston 2, Tex.*

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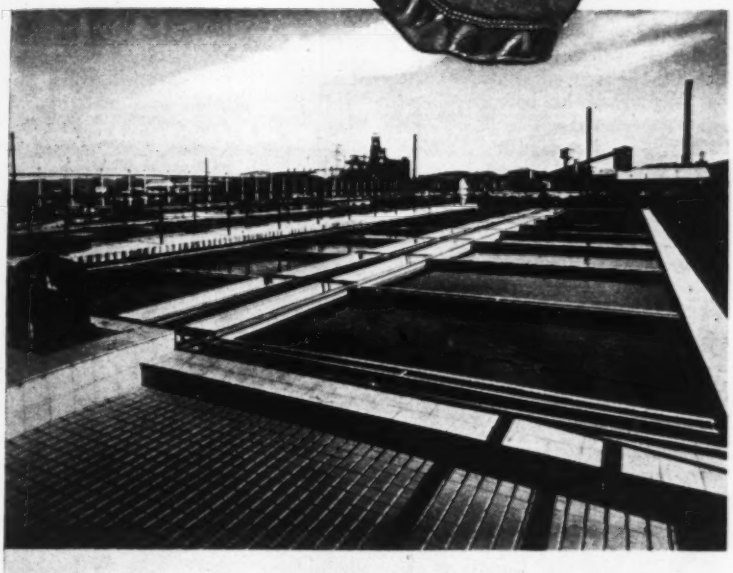

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Manufacturers' Activities

Sales—Thomas B. Moule is sales manager of the PLOMB TOOL CO., Los Angeles, Calif. . . . G. O. Britton is domestic sales manager and E. B. Schlenk district representative for the central area for ATHEY PRODUCTS CORP. . . . Frank L. Johnson is division sales manager of the OSGOOD CO. and the GENERAL EXCAVATOR CO., Marion, Ohio . . . The H. K. FERGUSON CO. has established a new sales office at 120 S. LaSalle St., Chicago managed by L. Douglas Lacy . . . John A Proven is general sales manager of the PORTER-CABLE MACHINE CO., Syracuse, N. Y. . . . Harold Gearin has joined the sales staff of FLUOR CORP. LTD. at the Los Angeles office . . .Carroll Edgar will represent KENNAMETAL, INC, of Latrobe, Pa. in the Seattle area . . . M. G. McGregor is sales manager of the AHLBERG BEARING CO., Chicago . . . Wendell V. Richards has been appointed central sales manager for R. G. LE TOURNEAU, INC., Peoria, Ill. . . . John W. Bogle is directing a new wholesale branch sales operation for the GENERAL TIRE & RUBBER CO. at Richmond, Va. . . . Geo. E. Sprackling is sales manager for the LANCASTER ENGINEERING CORP., Lancaster, Pa. . . . J. T. Gillespie, Jr, is sales manager for the WATSON-STILLMAN CO., Roselle, N. J. . . . Titus N. Radu is foreign sales manager of the ARCO CO, Cleveland and Los Angeles, manufacturers of paints and special coatings . . . Spencer R. Stuart is sales promotion manager for NU-HUE products, architectural finishes, MARTIN SENOUR CO., Chicago.

Distributors—A. J. BOHN CO. 803 Forsyth Bldg., Atlanta, Ga., is representative in Georgia, Alabama, Florida, North and South Carolina for VENITO FLOOR CO., Philadelphia, Pa. . . . AMERICAN BRASS & COPPER CO., Ashland, Calif., is distributor of aluminum products, REYNOLDS METALS CO., Louisville, Ky. . . . M. C. BURT EQUIPMENT CO., Rockford, is dealer in Illinois for DAVEY COMPRESSOR CO. . . . A. LIETZ CO., Los Angeles and San Francisco, is sales agent for the equipment of W. & L. E. GURLEY, Troy, N. Y., in California, Oregon, Nevada, Arizona, New Mexico and El Paso, Tex.

Personalties—Earl T. Larson is advertising director of the construction machinery companies of Waterloo, Iowa . . . C. B. Johnson is chief engineer and E. R. Gilmore, director of research for the PITTSBURGH EQUITABLE METER division of the ROCKWELL MFG. CO. and Paul E. Butzin is director of engineering of the DELTA MANUFACTURING division . . . Orville F. Figley is manager of the Chicago district of the U. S. STEEL SUPPLY CO., warehousing subsidiary of the U. S. STEEL CORP. Frederick L. Bruckner and Arthur W. Johnson are assistant district managers . . . After nearly 50 years of service in the paint industry, Phil C. Fraveer, merchandising manager of the MARTIN-SENOUR CO., Chicago, is to retire soon . . . Wm. J. McGraw is manager of the Cleveland, Ohio, branch of the INDEPENDENT PNEUMATIC TOOL CO. Aurora, Ill. . . . Geo. T. Williams has resigned as manager of THE CONTRACTORS' EQUIPMENT DEPT of THE MINE & SMELTER SUPPLY CO. His address is 3064 Clermont St., Denver 7, Colo. . . . J. C. Witt is now consulting engineer of the MARQUETTE MFG. CO., Chicago . . . John F. Hall is district engineer in charge of the New York office of the PORTLAND CEMENT ASSOCIATION, succeeding E. M. Fleming, retired . . . James M. Herring is service manager of the OSGOOD CO., Marion, Ohio. . . . Neal R. Fosseen, president of the WASHINGTON BRICK AND LIME CO., Spokane, Wash., has been elected to represent the Pacific Coast region on the board of directors of the NATIONAL CLAY PIPE MFGRS. ASSN. . . . Geo. C. Delp president of the New Holland (Pa.) Machine Co. has been elected a vice-president of THE SPERRY CORP. . . . H. X. Eschenbrenner, president of the UNIVERSAL CONCRETE PIPE CO., Columbus, Ohio, and his son, H. E. Eschenbrenner, have returned from Europe where they visited concrete pipe manufacturing plants in England, France, Belgium, Switzerland and Germany. . . . Richard C. Lawton is district engineer for western New York state at Rochester for the bearings division of THE TORRINGTON CO., Torrington, Conn., and South Bend, Ind. . . . W. W. Acuff is regional manager for the eastern region, building products division, REYNOLDS METALS CO. . . . Appointment of F. Penn Holter, Charles R. Shields, Charles K. Skinner and Frederick V. Courtade to new positions has been announced by the CONSTRUCTION MATERIALS DEPARTMENT of the GENERAL ELECTRIC CO. Mr. Holter has been named assistant manager of manufacturing. Mr. Shields has been appointed manager of marketing service, with headquarters at Bridgeport, Conn. Mr. Skinner has been named materials coordinator. Mr. Courtade becomes manufacturing engineer for the General Electric conduit products division.

Deceased—F. L. Jaeger, 70, who retired as vice-president of MARQUETTE CEMENT MFG. CO., six years ago, died

A FAST-MOVING MIXER...

3½—S Tilting Mixer. Capacity, 3½ cu. ft, plus 10% overload (A.G.C. rating).

Quickly spotted and towed, this half-bag mixer is a cost-cutting combination of strength, lightness and efficiency. Other Ransome Blue Brute Mixers in capacities up to 126 cu. ft.

AIR AT SHORT NOTICE...

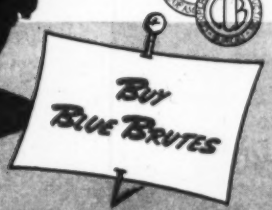
A light-weight, handy compressor that can get around *fast!* Powers light hand-held Rock Drill, Paving Breaker or equivalent air tools through its easy-breathing Feather* Valves — with unfailing dependability and economy.

*Reg. U. S. Pat. Off.

60′ Contractor's Portable Compressor. Other Blue Brute Compressors up to 500′ capacity.

PLENTY OF RESERVE POWER...

Blue Brute Self-Priming Centrifugal Pump. Built in A.G.C. sizes to A.G.C. standards.



Now! a Contractor's Pump by Worthington, the world's largest pump makers, with fast, dependable pickup that saves time and money. Rust- and abrasion-resistant, with built-in self-priming.

FOUR FAST WORKERS...

Though tough and powerful, Blue Brute Air Tools are light and compact, with the easy handling that means more satisfied workers . . . more work done . . . more profit for you.

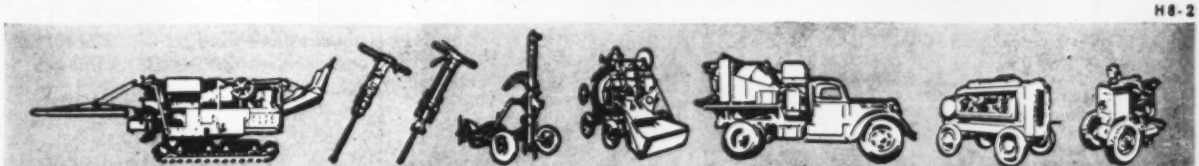
Paving Breaker, WB-50 | Rock Drill, WJ-45 | Clay Digger, W-19 | Backfill Tamper, W-8

BUY BLUE BRUTES

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Div'sion, Holyoke, Massachusetts. Distributors in all principal cities.

H8-2



IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

SINK 'EM AND FORGET 'EM!
THEY'RE KOPPERS PRESSURE-CREOSOTED FOUNDATION PILES
That's the beauty of installing Koppers Pressure-Creosoted Piles—they are in to stay. The permeation of creosote protects these piles against decay, termites and acid or alkaline soils. And the wood retains the creosote year after year. Here's proof: some pressure-creosoted piles were pulled after being in use for nearly fifty years; they were still "loaded with creosote."
Koppers Pressure-Creosoted Piles are quickly available . . . are ready to be driven when received . . . are usually lower in cost than other permanent pile materials. Specify Koppers and you'll get economical and permanent piling.
KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.
KOPPERS
PRESSURE-TREATED WOOD
Modern building codes for permanent structures accept foundation piles of pressure-creosoted wood, provided the cut-offs are soaked in creosote and capped in concrete.

in Chicago, Nov. 14 . . . M. L. Jacobs, 63, vice-president of the BETHLEHEM STEEL Co. died in Trinidad on Nov. 12 . . . J. Wm. Jay, 63, advertising manager for HENRY DISSTON & SONS, INC., for the last 15 years, died at Palmyra, N. J., Oct. 29 . . . Wm. B. Klee, 84, organizer of the WEIRTON and COPPERWELD steel companies, died in Pittsburgh Oct. 27.

Miscellany—WALLACE & TIERNAN, Belleville, N. J., recently celebrated their 35th anniversary. Charles F. Wallace and Martin F. Tiernan, founders, were present. WALLACE and TIERNAN and associated companies are prominent in the field of water purification . . . Construction of a steel warehouse serving the greater New York area is nearing completion by REPUBLIC STEEL CORP. in Long Island City . . . THE LEHIGH NAVIGATION COAL Co., INC. has announced the formation of a wholly-owned subsidiary, LEHIGH MATERIALS Co., and the construction of a plant to produce Lelite, a lightweight aggregate, main office, Lansford, Pa., and sales office, 143 Liberty St., New York City . . . CLIFFS CONSTRUCTION Co., Youngstown, Ohio, has been formed for heavy industrial moving and construction, structural steel and iron work, and field welding. It is headed by Charles S. McKinney . . . MASONITE CORP., Chicago, manufacturer of hardboards, plans to acquire ownership of at least 80 percent of the outstanding stock of MARSH WALL PRODUCTS, INC., of Dover, Ohio. . . . A customer service department has been established by BINKS MFG. Co., 3114 Carroll Ave., Chicago. The department is under Joseph Vokoun, with the company for 20 years . . . To help alleviate the nickel shortage, NEW JERSEY METAL Co., Elizabeth, N. J., is adding to its staff and expanding plant facilities and equipment to smelt and refine secondary nickel, its alloys, and other nickel-bearing products. Added to personnel are Joseph F. Sweeney and Wm. J. Swett, formerly with the INTERNATIONAL NICKEL Co., INC. . . . Clarence E. Witherspoon, president of the ASBESTOS CONSTRUCTION Co. INC., 607 West 29th St., New York City, was honored Nov. 5 at a dinner at the Engineers' Club to celebrate the 25th anniversary of the founding of the company. The dinner was given by JOHNS-MANVILLE CORP. . . . Promotion of T. J. Zeller to factory manager of its Allentown, Pa., plant, succeeding C. J. Moran, and advancement of A. C. Schliewen to manager of its Plainfield, N. J., plant, succeeding Mr. Zeller, has been announced by MACK TRUCKS, INC. Mr. Moran has been transferred to Mack's western sales headquarters located in Los Angeles, Cal.

Reports and Pamphlets

(*Continued from page 112*)

THE TRAFFIC DESIGN OF PARKING GARAGES. The Eno Foundation for Highway Traffic Control, Saugatuck, Conn.

REGULATIONS AND PRINCIPAL STATUTES—Applicable to Contractors and Subcontractors on Public Building and Public Work and on Building and Work Financed in Whole or in Part by Loans or Grants from the United States. U. S. Department of Labor, Washington, D. C.

A WORK STUDY IN BLOCKLAYING—Technical Paper No. 1. Building Research Station, Garston, Watford, Herts, England. Price 1s. 6d.

THE SOUND INSULATION OF PARTITIONS—National Physical Laboratory. Department of Scientific and Industrial Research, London. Price 6d.

COMPUTATION OF TRAFFIC STRESSES IN A SIMPLE ROAD STRUCTURE—Road Research Technical Paper No. 9. Department of Scientific and Industrial Research, Road Research Laboratory, West Drayton, Middlesex, England. Price 9d.

SOME PROPERTIES OF PAPER-OVERLAID VENEER AND PLYWOOD—Technical Paper No. 9. Housing and Home Finance Agency, Washington 25, D. C.

PROPOSED KINGSTON-RHINECLIFF BRIDGE OVER THE HUDSON RIVER—Report by D. B. Steinman to the New York State Bridge Authority, Poughkeepsie, N. Y.

NEW HAVEN'S PROGRAM FOR PUBLIC IMPROVEMENTS 1949-1954. Capital Budget Programming Committee 1948, New Haven, Conn.

OPERATING UNDER THE TAFT-HARTLEY ACT—A Practical Explanation of How the New Law Works—Revised Edition. By Max Malin and S. Herbert Unterberger. The Labor Relations Information Bureau, Washington 1, D. C. $2.

THE WATER RESOURCES OF MONTGOMERY COUNTY, OHIO—Bulletin 12. Ohio Water Resources Board, Columbus, Ohio.

POWER ON THE RAILS—A paper by L. K. Sillcox before the American Institute of Consulting Engineers, 75 West St., New York.

SPILLWAY FOR DETROIT DAM, NORTH SANTIAM RIVER, OREGON—Technical Memorandum No. 2-260. Waterways Experiment Station, Vicksburg, Miss. Price $1.

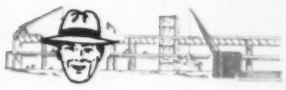
RESEARCH ON STRESS-DEFORMATION AND STRENGTH CHARACTERISTICS OF SOILS AND SOFT ROCKS UNDER TRANSIENT LOADING—Soil Mechanics Series No. 31. Graduate School of Engineering, Harvard University, Cambridge, Mass.

HIGHWAYS IN WASHINGTON'S FUTURE—An Engineering Study Prepared for the Washington State Legislature by G. Donald Kennedy and staff, Automotive Safety Foundation, Washington 6, D. C.

THE EFFECT OF THE SOIL FOUNDATION ON THE ROAD SURFACE—Road Research Technical Paper No. 11 (Great Britain). His Majesty's Stationery Office, London. Price 1s. 3d.

COMPUTATION OF TRAFFIC STRESSES IN A SIMPLE ROAD STRUCTURE—Road Research Technical Paper No. 9 (Great Britain). His Majesty's Stationery Office, London. Price 9d.

"Why Ætna is our Surety . . ."



"**Prompt service is vitally important to us,**" said a general contractor. "When an unusual problem arises, our surety must have the necessary experience, technical knowledge, and thorough understanding of our business to reach a decision quickly. *Ætna fills the bill.*"

"**Strong, nation-wide facilities** are important to us," said a bridge-builder. "Our surety must offer prompt, intelligent, on-the-spot service in 48 states. It must have strong financial resources and be able to supply bonds of any size we may require. *Ætna is our choice.*"

"**Acceptability is our test,**" said a highway specialist. "We are a growing concern, expanding constantly into new areas. We know the value of dealing with a Surety whose name is nationally known, whose bonds are readily accepted by public and private authorities anywhere in the United States. That's why we *deal with Ætna.*"

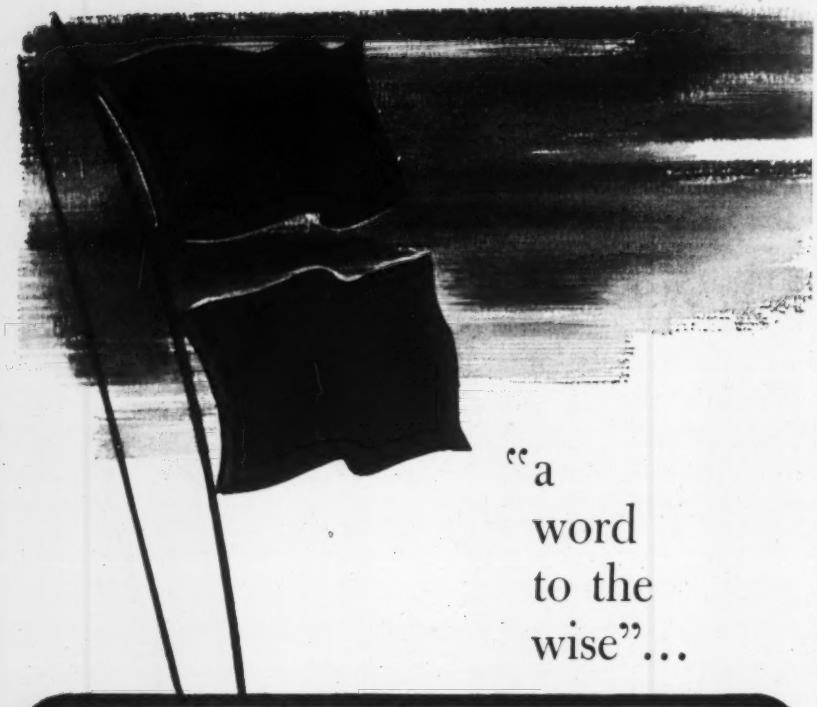
Agents from coast to coast

Ætna Casualty and Surety Company

Affiliated with Ætna Life Insurance Company

Automobile Insurance Company • Standard Fire Insurance Company

HARTFORD 15, CONNECTICUT



"a word to the wise"...

STORM WARNINGS ARE FLYING

Cold and wet weather ahead means *you* will need tarps—and when you need them...you want them PRONTO!

Send out your S. O. S. to your dependable Wenzel distributor. He will fill your tarpaulin requirements immediately from his complete stock.

For cold and rain... **SPECIFY** ***Wenzel "Para" Waterproofed Tarpaulins.***

Processed with a genuine paraffin base—Para Tarpaulins contain no oil or clay. They are air-dried... never exposed to damaging heat. Para Tarpaulins are completely waterproof, stronger and tougher... to give you PLUS-SERVICE.

For added Fire-Protection...**SPECIFY** ***Wenzel Fire and Water Resistant Tarpaulins.***

These new, high-quality Tarpaulins are processed by a new-improved method. Guaranteed to give you longer service and greater protection against fire-loss.

Full breaking strength — guaranteed new ...not Government Surplus. Duck woven... treated... after Sept. 1, 1948. No risk of fabric weakening due to long storage and prolonged chemical action.

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Stillwell Supply Corp., Long Island City
Trevor Corp., Buffalo
R. B. Wing & Son Corp., Albany
NEW JERSEY
Dale & Rankin, Inc., Newark
WASHINGTON, D. C.
Hovey-King Co.
Hudson Supply & Equip. Co.
MARYLAND
General Supply & Equipment Co., Inc., Baltimore
NORTH CAROLINA
Constructors Supply Co., Durham
Contractors Service, Inc., Charlotte
VIRGINIA
Rish Equipment Co., Roanoke
WEST VIRGINIA
Rish Equipment Co., Charleston
PENNSYLVANIA
Austin Supply Co., Inc., Philadelphia
Dravo-Doyle Co., Pittsburgh
OHIO
Rish Equipment Co., Cincinnati
The W. T. Walsh Equipment Co., Cleveland
MICHIGAN
Contractors Machinery Co., Grand Rapids
WISCONSIN
Prime-Best, Inc., Milwaukee
MINNESOTA
Minneapolis Equipment Co., Minneapolis
SOUTH DAKOTA
Pecaut Industrial Supply Co., Sioux Falls
NEBRASKA
Anderson Equipment Co., Omaha
IOWA
Harry Alter & Sons, Davenport
Pecaut Industrial Supply Co., Sioux City
ILLINOIS
Clark & Barlow Hdwe. Co., Chicago
Joseph Behr & Sons, Rockford
Becker Equipment & Supply Co., Chicago
INDIANA
Standard Equipment & Supply Corp., Hammond
MISSOURI
Brown-Strauss Corp., Kansas City
Machinery & Supplies Co., Inc., Kansas City
The Victor L. Phillips Co., Kansas City
MISSISSIPPI
Contractors Material Co., Inc., Jackson
LOUISIANA
Pelican Well Tool & Supply Co., Shreveport
TEXAS
J. E. Ingram Equipment Co., San Antonio
OKLAHOMA
Mideke Supply Co., Oklahoma City
The Victor L. Phillips Co., Oklahoma City
ARIZONA
Industrial Equipment Co. of Arizona, Phoenix
CALIFORNIA
Industrial Equipment Co. of Southern California, Los Angeles
Standard Machinery Co., San Francisco

For 61 Years... America's Foremost Manufacturer of Quality Tarpaulins

DIRECTORY OF NORTH DAKOTA MUNICIPAL OFFICIALS 1948-1949. League of North Dakota Municipalities, Bismarck, N. D. $3.

THE PAY-OFF IN RESEARCH—Engineering College Research Council of the American Society for Engineering Education, State University of Iowa, Iowa City. $.50.

PROCEEDINGS — Twenty-Seventh Annual Meeting, National Council of State Boards of Engineering Examiners. Box 1404, Columbia, S. C.

A GUIDE TO STATE SERVICES—Department of Commerce, State of New York, Albany, N. Y.

STAGES AND DISCHARGES MISSISSIPPI RIVER AND ITS OUTLETS AND TRIBUTARIES, 1945. Mississippi River Commission, Vicksburg, Miss. $.75.

A.S.T.M. STANDARDS ON MINERAL AGGREGATES, CONCRETE, AND NONBITUMINOUS HIGHWAY MATERIALS—American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $2.25.

A.S.T.M. STANDARDS ON BITUMINOUS MATERIALS FOR HIGHWAY CONSTRUCTION, WATERPROOFING, AND ROOFING—American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $3.

FLOOD FLOWS AND STAGES IN SACRAMENTO (CALIFORNIA) AND NORTHERN SAN JOAQUIN VALLEYS, 1946-48—Division of Water Resources, Sacramento, Calif.

IRRIGATION TUNNEL FOR ST. MARY DAM, ST. MARY-MILK RIVER PROJECT, ALBERTA, CANADA—Technical Memorandum No. 2-262. Waterways Experiment Station, Vicksburg, Miss. $1.

RED LEAD PRIMERS FOR ATMOSPHERIC EXPOSURE—Red Lead Technical Letter No. 3. Lead Industries Association, 420 Lexington Ave., New York 17.

BIBLIOGRAPHY ON PRESTRESSED REINFORCED CONCRETE—ESL Bibliography No. 2. Engineering Societies Library, 29 West 39th St., New York 18. $4.

HIGHWAY TRANSPORTATION SYSTEM IN OREGON—PRESENT AND FUTURE NEEDS—Automotive Safety Foundation, 700 Hill Building, Washington 6, D. C.

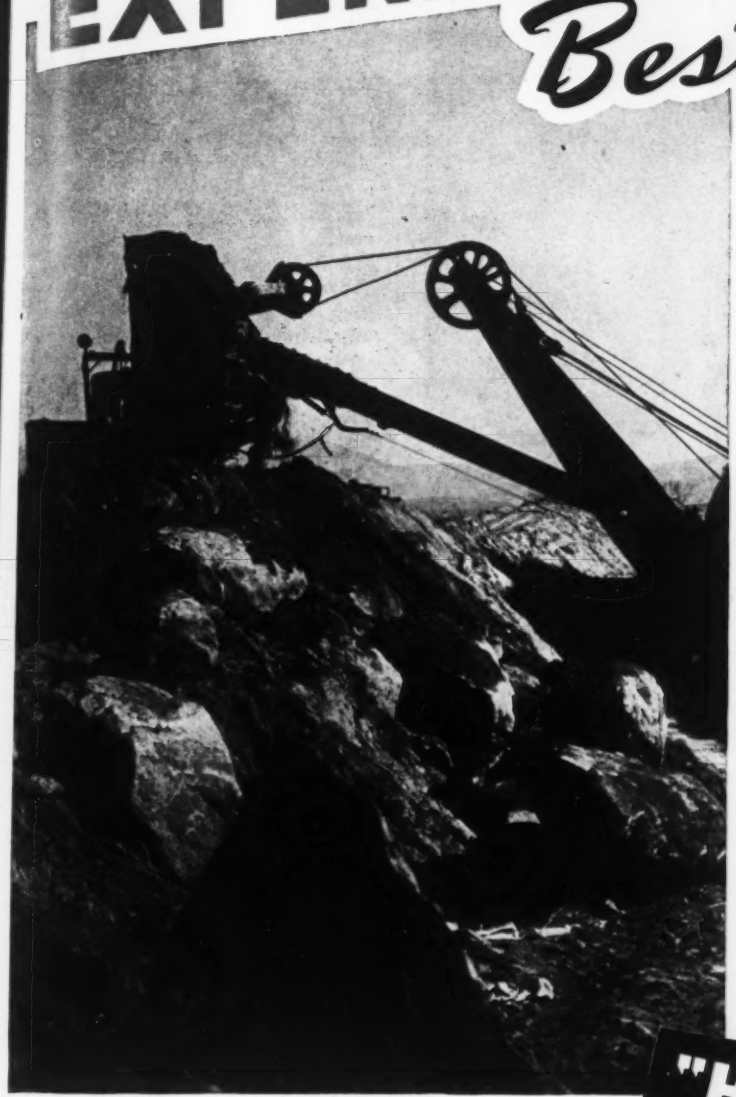
HOSPITAL SURVEY AND PLAN FOR THE STATE OF MARYLAND. Maryland State Planning Commission, Baltimore 2, Md. $1.

STANDARDS OF HYDRAULIC INSTITUTE—Eighth Edition. The Hydraulic Institute, 90 West St., New York 6, N. Y. $3.

Miscellaneous Notes on Booklets and Reprints

AN EXPLANATION of the phenomenon of surface wear and breakdown is given in a pamphlet, "Flooring Hardwoods." Photo-micrographs show that, in general, the resistance of wood surfaces to actual breakdown is not entirely related to density but is appreciably affected by anatomical structure, particularly the arrangement, size and distribution of the pores. This bulletin may be obtained from the Director, Forest Products Research Laboratory, Aylesbury, Bucks, England, for one shilling.

EXPERIENCE *is The Best* GUIDE!



Men who use shovels or similar types of heavy duty material handling equipment, need not be reminded of the important part that wire rope plays in determining their final production costs.

Experience has proved that the longer a rope lasts, the lower is its cost per unit of work done. Less time, too, is wasted in making replacements.

It is *also the experience* of a large number of Wire Rope users that they can depend on Preformed "HERCULES" (Red-Strand) Wire Rope for top-flight performance. Its toughness . . . its easy spooling . . . its unusual endurance—make for longer life, faster work, and lower operating cost.

Our Engineering Department will gladly submit detailed recommendations for any Wire Rope Job! Just ask us.

"HERCULES"* the DEPENDABLE WIRE ROPE for *any* TOUGH JOB

* REG. U.S. PAT. OFF.

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

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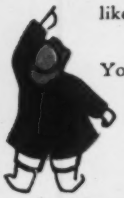
"Automatic" Sprinklers ... A Vital Business Economy for Industry the World Over

ARE you in a position to definitely measure the over-all cost of destruction, should fire reduce your plant or property to a shambles of twisted steel or broken concrete? We doubt it, for fire loss represents considerably more than is visible in the destruction of buildings, equipment and records. It means the interruption of production and service, the reduction of assets and increased liabilities. It means temporary and perhaps permanent loss of customers. In short, it could well mean the financial ruin of your entire business enterprise.

On the brighter side of this picture of fire destruction stand "Automatic" Sprinklers, industry's most effective weapon against fire. For, "Automatic" Sprinkler systems are supersensitive to the very indication of flame. They make the fire extinguish itself, even before it can make headway. And, on the financial side, "Automatic" Sprinklers, like any other capital asset, can be amortized over a given period of years, with their initial cost ultimately taken as an operating expense.



You and every other executive with an appreciation of business economy must not overlook the importance of fire safety with "Automatic" Sprinklers, *an important investment today . . . perhaps welcomed protection tomorrow.*

"Automatic" Sprinkler

FIRST IN FIRE PROTECTION

DEVELOPMENT · ENGINEERING MANUFACTURE · INSTALLATION

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN 1, OHIO

OFFICES IN PRINCIPAL CITIES OF NORTH and SOUTH AMERICA

Elections and Activities

New officers of the junior branch of the Central Illinois section of the ASCE are W. G. Murphy, Urbana, president; H. O. Ireland, Champaign, vice-president; and W. F. Lytle, Champaign, secretary-treasurer. They replace the 1947-48 officers, W. H. Munse, president; M. W. Jackson, vice-president and C. E. Kesler, secretary-treasurer.

Baxter Wade, Jackson, Miss., has been elected chairman of the Alabama-Mississippi branch of the American Waterworks Association, succeeding Arthur N. Beck, of Montgomery. Others elected are: George Goodwin, Decatur, vice-chairman, and J. L. Snow, Montgomery, secretary-treasurer.

The Washington State Good Roads Association has elected Lyle Abrahamson of Tacoma as president, with Douglas Shelor of Seattle as executive vice-president, and Herbert J. Shaw of Seattle treasurer. It approved a resolution recommending that the state legislature use an interim committee report on highways as the basis of future highway improvements.

The Texas Section of the American Society of Civil Engineers has elected these officers: Williard Simpson, San Antonio, president; Phil Ferguson, Austin, first vice-president; H. R. Norman, Galveston, second vice-president. I. W. Sanbry, Jr., Dallas, is secretary, serving his second year.

J. J. Walsh, secretary of the North Dakota state water conservation commission, and a North Dakota state engineer, was recently elected president of the Association of Western State Engineers.

John E. Driscoll of Holyoke has been reelected chairman of the Massachusetts Federation of Planning Boards. Other officers, all re-elected, are: vice-chairman, Justin R. Hartzog, of Cambridge; treasurer, Hilton W. Long of Dover; secretary, Ralph W. Horne of Boston, and chairman ex-officio, Elizabeth M. Herlihy of Boston.

Kenneth Knight of Rocky Mount, N. C., has been elected president of the East Carolina Engineers Club, succeeding J. C. Gardner of Tarboro. Others to take office Jan. 1 are: W. E. Titchener of Wilson, vice-president; and City

FOSTER'S RAILS

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TRACK ACCESSORIES

Write for Folder F-101

RAIL • TRACK ACCESSORIES • PILING • PIPE • WIRE ROPE

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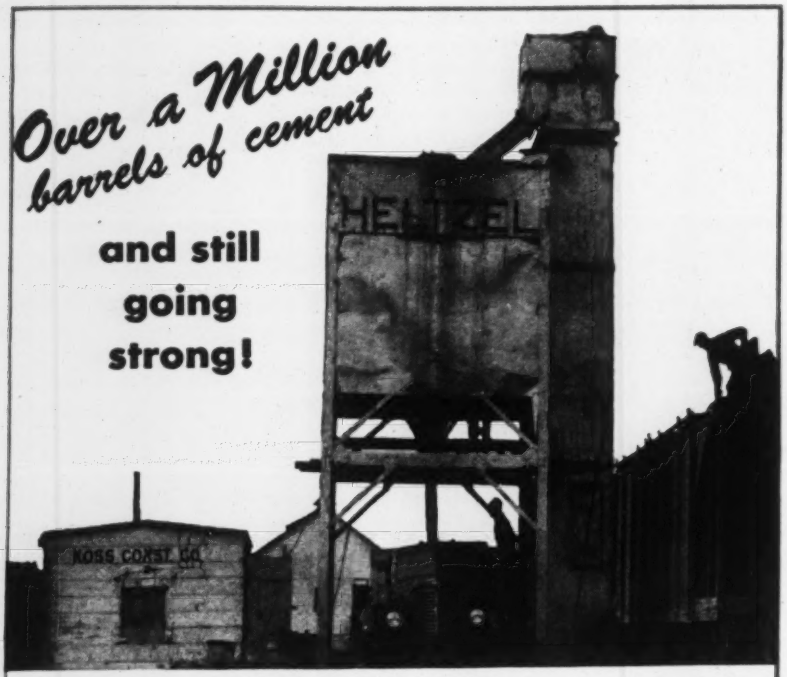
Five convenient warehouses for prompt delivery



VETERAN HELTZEL PLANT HAS REPAID ITS COST 42 TIMES OVER IN 17 YEARS . . .

• 1,160,500 barrels of cement have been unloaded by this plant. In 1931, time studies indicated the plant cost would be repaid at the handling of 25,000 to 30,000 barrels. (Note comments by Mr. Koss in the following letter.)

KOSS CONSTRUCTION CO.
General Contractors Since 1914
DES MOINES, IOWA

April 21, 1948

Mr. Donald T. Heltzel
Heltzel Steel Form and Iron Co.
Warren, Ohio

Dear Sir:

Our records indicate this bin was purchased by us in 1931. It has been used by us on paving projects all over the middle-west from that time until the present and is still a good plant and doing a fine job. During this period, we have unloaded 1,160,500 barrels of cement with the Heltzel, including box cars, hopper bottoms and truck delivery. You can be justifiably proud of the performance of this equipment.

Yours very truly,

Richard B. Koss
Richard B. Koss
Vice President

RBK:m

Heltzel plants are products of specialized engineering, and constructed for lasting, trouble-free service. Your requirements for plants will be served best by Heltzel. Write for information and literature.

CONCRETE BUCKETS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

Manager William J. Heard of Kinston, re-elected secretary-treasurer. Included in membership are engineers from Kinston, Goldsboro, Tarboro, Rocky Mount, Williamston, Wilson, Greenville, New Bern, and Roanoke Rapids.

Raymond Archibald of the J. E. Greiner Co., Baltimore, Md., has been appointed to a five-year term as a member of the executive committee of the structural division of the American Society of Civil Engineers.

To recognize meritorious achievement and to stimulate thought by young engineers, the Engineering Societies of New England will sponsor an essay contest for their younger members, according to the societies' President, Dean William C. White of Northeastern University. All members of ESNE who will not have reached their 30th birthday by the deadline date for the submission of essays—March 1, 1949—are eligible to compete. Cash prizes totalling $100 will be awarded to the winning contestants. The essay topic is "The Obligations of the Engineer to a Free Society."

At the recent annual meeting of the Four States section of the AWWA the George Warren Fuller Award was presented to Harry R. Hall, chief engineer of the Montgomery and Prince Georges County, Md., utility agency and a member of the Washington Suburban Sanitary Commission for "his effective service in the sanitary engineering field."

The new home of the Engineers Club at 96 Beacon Street, Boston, Mass., was dedicated recently at a meeting of 350 members and guests. During the last 35 years, the club has had headquarters at 2 Commonwealth Avenue but recently bought the Beacon Street Building and completely renovated it. The club, which was founded in 1911, is comprised of more than 450 engineers and men interested in science and its applications. Nehemiah Boynton, Jr., is president, Matthew J. Cummings, treasurer; and Frederick P. Coffey, secretary. William R. Coleman was chairman of the dedication exercises.

Prof. Lynn Helander, of the faculty of Kansas State College, has been elected president of the Kansas-Nebraska section of the American Society for Engineering Education. He succeeds Prof. Harry L. Daasch of the University of Kansas. Other officers are: Prof. George Bradshaw, University of Kansas, vice-president; Prof. George Ernest, University of Nebraska, secretary-treasurer, and Prof. William De Baufre, University of Nebraska, representative on the national council.

Men and Jobs

William T. Bonsor, center, supervisor of streets, San Francisco, joins W. J. Dibble, left, and M. P. Youker, of the Oronite Chemical Co., 38 Sansone St., San Francisco, in examining the suds resulting from the use of a new detergent on a city street. Five pounds of the solvent powder will make 1,500 gal. of suds. The solution was sprayed from a water sprinkler as shown on page 13 of the Nov. 18 issue.

Samuel W. Cotton of Petersburg, Va., is assistant engineer of Harrisonburg, Va. He is a 1948 graduate of Virginia Tech, and a veteran.

Leon Hyzen, architect and industrial designer, has moved from 53 W. Burton Place, Chicago, Ill., to 1129 North Dearborn St., to enlarge his practice in architecture, store planning and industrial design. A graduate of the Massachusetts Institute of Technology, during the war he was site planner of the Bermuda Army Post, and chief site planner of the Bainbridge Naval Training station.

Capt. O. W. Swainson, San Francisco, Calif., has retired as supervisor of the Western district, United States Coast and Geodetic Survey. During his 38 years of service, he has charted portions of all the ocean waters belonging to the U. S. He was chief of the Division of Terrestrial Magnetism and Seismology during the war, and under his direction the Pacific Coast committee of engineers was set up to study the effects of severe earthquakes. He will be succeeded by **Capt. F. A. Studds,** 30 years with the Survey.

J. H. Hawes, municipal engineer, Owen Sound, Ont., has been superannuated and replaced by **F. H. Cooke.**

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#11 of a series of informative articles on insurance and bonding.

FREE booklet helps employers encourage honesty of employees

In a booklet entitled "Are You Your Brother's Keeper?", Lawrence W. Miles, C.P.A., points out:

Many employers have come to realize that in addition to affording proper working conditions, reasonable hours, adequate wages and opportunities for advancement, they also have a definite moral obligation to do everything within reason to prevent their employees from succumbing to the temptation of dishonesty.

Mr. Miles then examines the whole problem of employee dishonesty and shows how employers may help prevent it. These subject headings give some idea of the scope of the work:

Checking References	Control of Merchandise
Safeguarding Receipts	Inventory and Stocktaking
Controlling Disbursements	Payroll Precautions
Check Cashing	Independent Audits
Test Checks and Receipts	Fidelity Bond Protection

In covering these and other subjects, Mr. Miles gives authoritative and practical suggestions to help employers safeguard the inherent honesty of their employees. For, as Mr. Miles says in his closing paragraph:

In the belief that many employers are deeply conscious of their responsibilities to their employees, the suggestions here advanced are offered with the hope that some may be aided in better meeting these responsibilities and in answering the question "Am I my brother's keeper?"—"I am!"

This valuable booklet is published by the Hartford as a service to American business. A copy will be sent without obligation to any employer requesting it.

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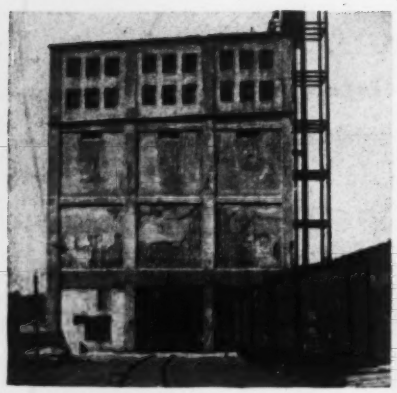

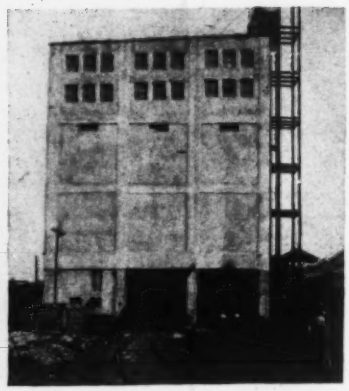

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ONAN ELECTRIC PLANTS

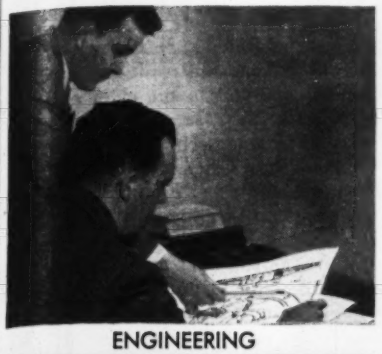
Charles R. Velzy has joined Nussbaumer and Clarke of Buffalo, N. Y. He was recently employed by Buck, Seifert and Jost of New York, and formerly was with Greeley and Hansen of Chicago for 25 years. He has worked on design and construction of sewerage projects, and has supervised projects for Urbana-Champaign, Ill.; Oklahoma City, Okla.; Grand Rapids, Mich.; Buffalo, N. Y.; Hampton Roads, Va., and on some New York City works. He designed and supervised construction on the treatment plant for the Pentagon Building while employed in a consulting capacity by the War Department. The Buffalo work was a $15,000,000 project for intercepting sewers, sewage treatment plant and pumping stations. Following construction of the Buffalo plant, Mr. Velzy remained as superintendent of operation for four years. Nussbaumer and Clarke specialize in water supply, sewerage and drainage, garbage collection and disposal, and town planning. Mr. Nussbaumer served four years as commissioner of public works of Buffalo. The new name of the firm is Nussbaumer, Clark and Velzy, Inc., and it will have an office under Mr. Velzy's direction at 52 Vanderbilt Avenue, New York City.

E. R. Crocker, Bureau of Reclamation engineer for 39 years, has been named builder of the Santa Barbara County, Calif., Project, which includes Cachuma Dam, the six-mile Tecolote Tunnel and the South Coast Conduit. **Jerome Fertig,** who did the planning work, has become chief of the development division at Santa Barbara. Crocker's project office is in Goleta.

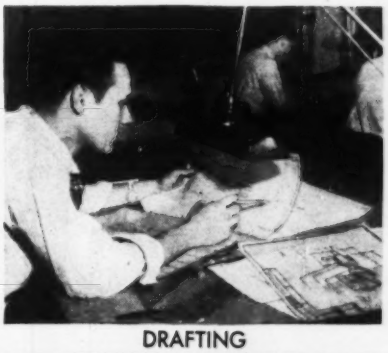
John F. Porter has resigned as service director at Galion, Ohio, to become city manager and superintendent of the water department in Grant Pass, Ore.

A. G. Morgan, in engineering and construction for more than 35 years, has joined Peterson, Hoffman & Barber, Toledo, Ohio, as engineer in charge of construction. During most of the last 16 years he has been with the Ohio Highway Department, but during World War II served as regional engineer for the federal war housing program in Ohio, Michigan, and Kentucky.

R. W. Kutzer of Palestine, Tex., civil engineer with the Texas State Highway Department for five years, has been appointed county engineer of Henderson County. He is a civil engineering graduate of the University of Texas. He succeeds **Frank Galloway,** who resigned to go with the Texas State Highway Department at Lufkin.



ENGINEERING



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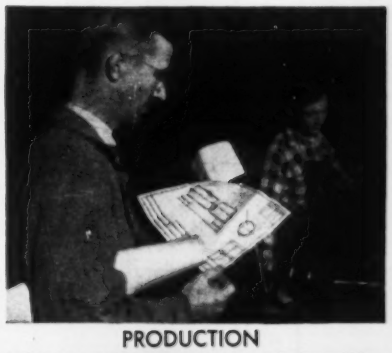

PRODUCTION

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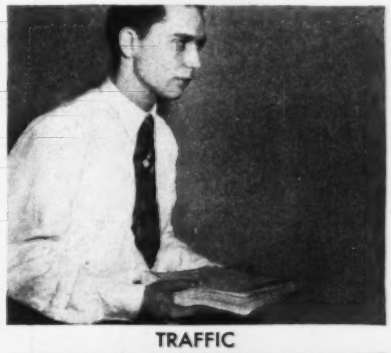

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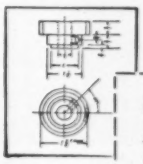

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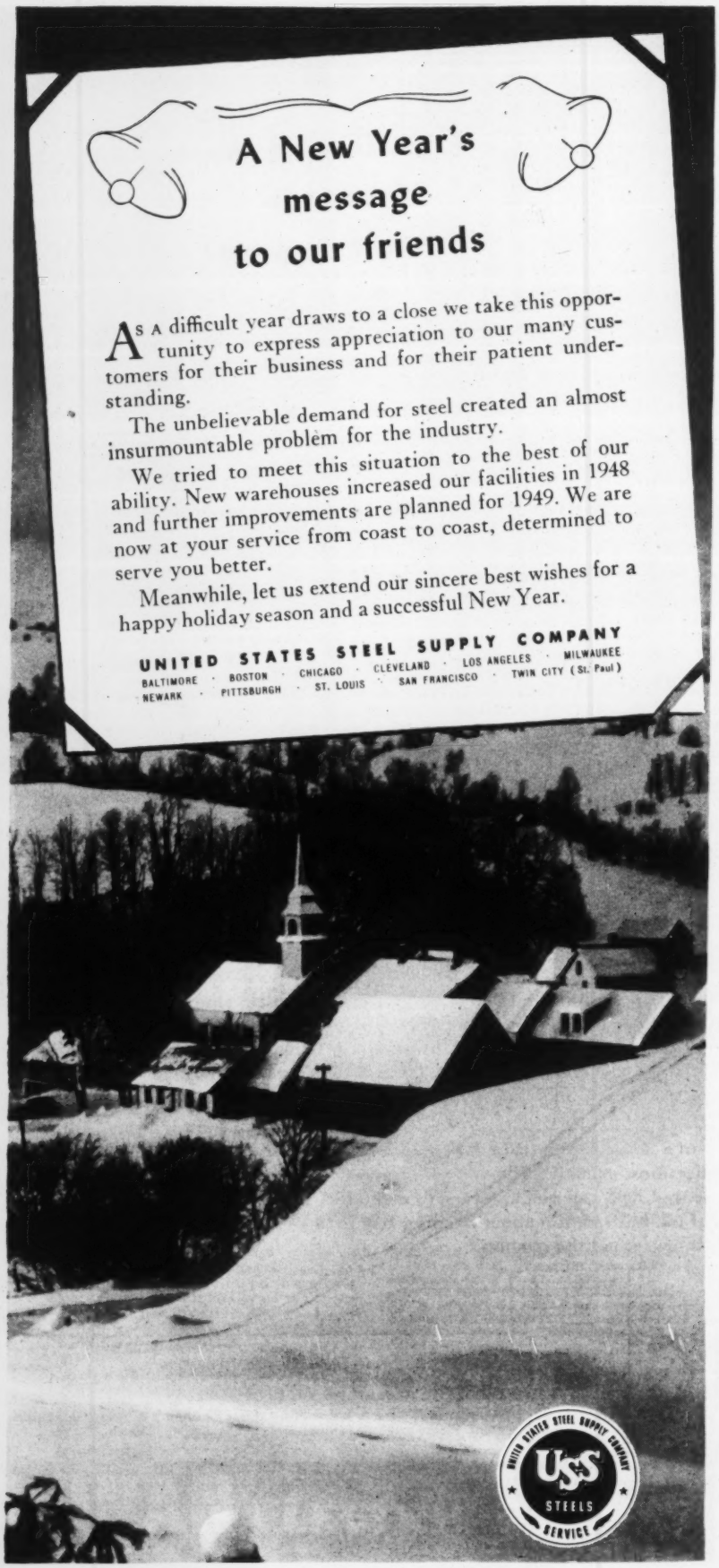
A New Year's message to our friends
As a difficult year draws to a close we take this opportunity to express appreciation to our many customers for their business and for their patient understanding.
The unbelievable demand for steel created an almost insurmountable problem for the industry.
We tried to meet this situation to the best of our ability. New warehouses increased our facilities in 1948 and further improvements are planned for 1949. We are now at your service from coast to coast, determined to serve you better.
Meanwhile, let us extend our sincere best wishes for a happy holiday season and a successful New Year.
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USS STEELS SERVICE

T. B. Hutcheson, assistant division engineer at Raleigh, N. C., for the Seaboard Air Line Railroad, has been appointed assistant to the chief engineer at Norfolk, Va. He replaces **J. H. Gill** who, after being with the railroad for 24 years, has resigned to enter private business at Starke, Fla. Hutcheson is a graduate of Virginia Polytechnic Institute, and joined Seaboard in 1935, serving at Tampa, Fla., and Atlanta, Ga., prior to going to Raleigh. Gill joined Seaboard in 1925 at Raleigh, and subsequently served at Jacksonville, Fla., Richmond, Va., Monroe, N. C., Hamlet, N. C., Atlanta, Ga., Savannah, Ga., and Norfolk.

James Hansen has been appointed city engineer of Neillsville, Wis.

Charles S. Lumley has been appointed executive vice-president and director of engineering, and a director of the H. E. Beyster Corp., Detroit, Mich. He has had wide experience as a professional engineer and administrator both in the United States and abroad. The corporation engineered the industrialization and rehabilitation program for the Philippines.

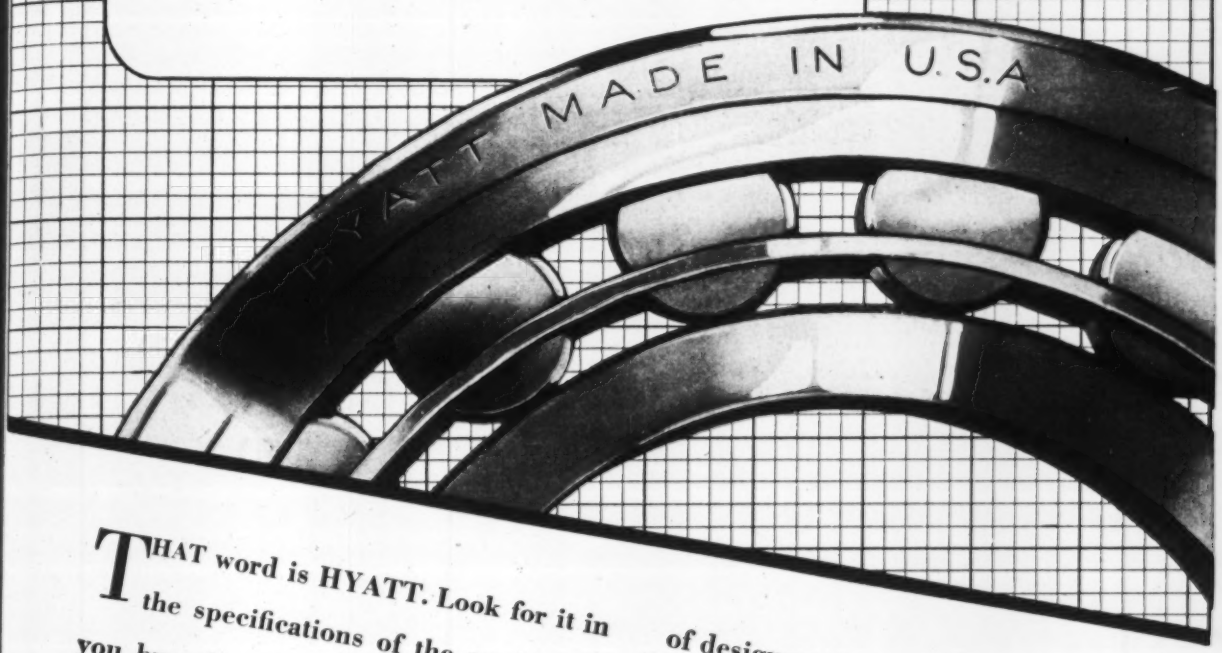
Harold Gibson has become city engineer for Wellington, Kan., after serving as county engineer for Cowley County at Winfield since February 1947.

J. N. Smith is district engineer of the West Virginia highway department at Huntington, succeeding **Charles H. Boggs,** transferred to Charleston.

William H. Voltz, operating engineer for the Washington, D. C., highway department since 1947, has been promoted to planning engineer for the department of vehicles and traffic, succeeding **William D. Heath,** who goes to the highway department as office engineer. Voltz, who spent 15 years in the bureau of traffic planning at Pittsburgh, Pa., before going to Washington, will be in charge of all designs and surveys for the department of vehicles and traffic. Heath has been a District employee since 1928 when he started with the highway department.

Rufus W. Putnam, Los Angeles consulting engineer, has been named executive officer of the California State Lands Commission. He succeeds Robert C. Hunter, Sacramento, who resigned because of ill health. A former Army engineer, as was Hunter, Putnam served as district engineer, Los Angeles district, during World War II. He was director of the Chicago Regional Port Commission from 1931 to 1942.

A word for the buyer of construction equipment



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OBITUARY

Oscar B. Coblentz, 70, chairman of the board of the McLean Contracting Co., Baltimore, Md., died in that city Nov. 22. After having been graduated from St. Johns College in Annapolis and the University of Maryland Law School, he became superintendent of schools in Frederick County and city engineer for Frederick in 1904. In 1908 he became chief engineer of the Frederick Railroad and engaged in various engineering, legal and construction activities until 1916 when he became president of the McLean Contracting Co., which specializes in heavy engineering and marine construction. From 1928 to 1934 he was also vice-president of the Merritt-Chapman & Scott Corp. He served as president of the Associated General Contractors of America during 1943.

Egbert H. Booth, 77, retired construction engineer, died in New Rochelle, N. Y., Nov. 24.

Capt. Lybrand P. Smith, 57, USN, retired, professor emeritus of naval engineering at the Massachusetts Institute of Technology, died at Cambridge, Mass., Nov. 25. He was graduated from the U. S. Naval Academy in 1911. After naval service in the first world war, he was on naval engineering duty from 1923 to 1943. During the recent war he was a member of the National Defense Research Committee.

Brent Skinner Drane, 67, of Chapel Hill, N. C., hydraulic and civil engineer, died Nov. 23. A graduate of the University of North Carolina engineering school, he formerly served as North Carolina state geologist, as director of the North Carolina Geological and Economic Survey, as division engineer for the Puerto Rico Irrigation Service, as city engineer at Charlotte, N. C., and as chief engineer with the R. G. Lassiter and Co., Charlotte construction firm. He also formerly served with the United States Geological Survey and the United States Reclamation Service. In 1934 he was appointed to the National Resources Planning Board, and was executive engineer with the Water Resources Division until its termination. He later was recalled to government service as a member of the Panel of Hydrology of the Committee on Geophysical Sciences of the Research and Development Board.

Leonard Gregory Dandeno, 59, civil engineer and manager of the Central Ontario Region for the Hydro-Electric

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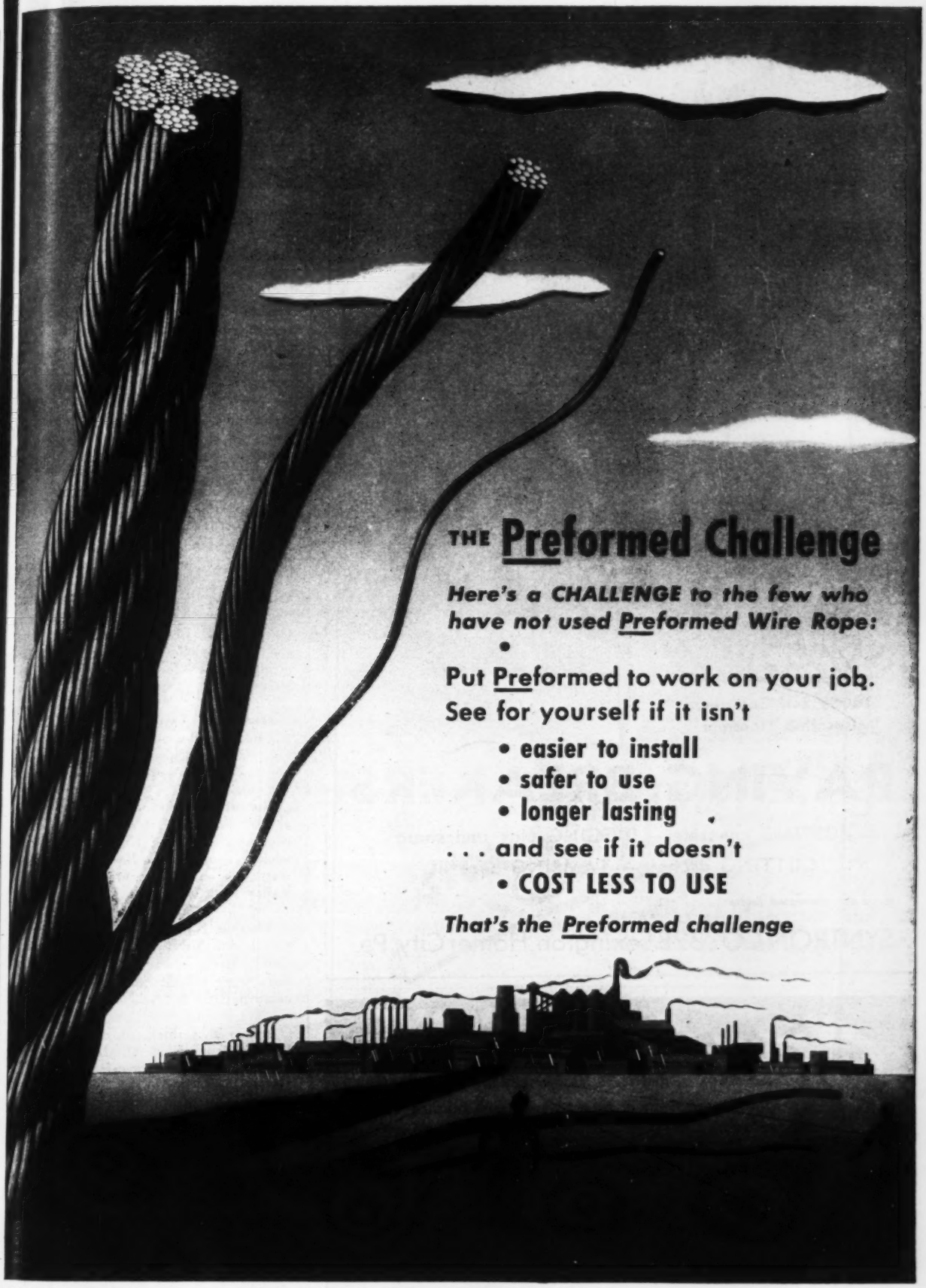
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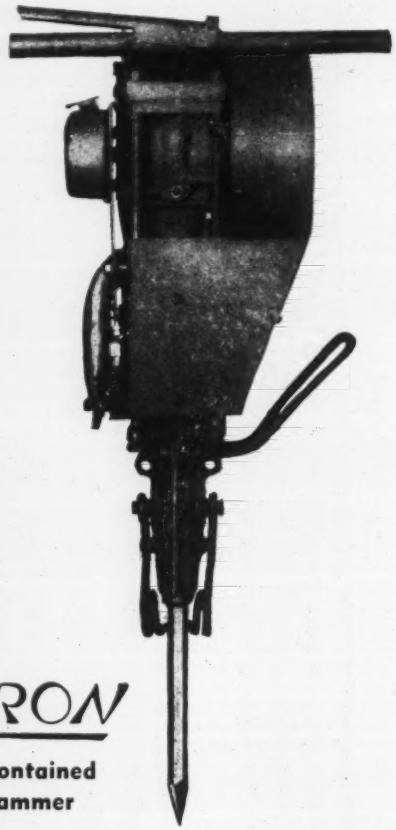

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Commission of Ontario, died at Belleville, Ont., Nov. 22.

H. George Hammond, 65, contracting engineer, died Nov. 21 in Rochester, N. Y. In 1910, Mr. Hammond led an expedition into the interior of Colombia to exploit the natural resources of the jungle. He worked on the Panama Canal and constructed sugar refineries in Haiti.

Lieut. Comdr. Charles Francis Chenworth, 41, civil engineer and U. S. Coast Guard survey and chart expert with the U. S. Coast and Geodetic Survey in Norfolk, Va., died Nov. 19 in Norfolk. He took a degree in civil engineering from the Catholic University in 1930. He went on duty with the Coast and Geodetic Survey in 1930 and later served on charting operations along the United States coast and in strategic waters of Alaska until 1944.

J. Harry Adolph, 62, a civil engineer who served 35 years with the New York State Division of Highways, died Nov. 13 at Highland Falls, N. Y. He joined the State Department of Public Works after his graduation from Rensselaer Polytechnic Institute in 1908. He had been county assistant in Tioga, Allegheny and Livingston Counties and assistant division engineer in charge of maintenance for the Hornell division. He retired in 1943.

Harold D. Van Vranken, 50, chief engineer of the Jacksonville Terminal Co., died in Jacksonville, Fla., Nov. 20. He was a veteran of the first world war.

Robert B. Straton, 82, died recently at Rumford, Me. He studied civil engineering at the University of New Brunswick, Fredericton, N. B. At one time he was chief engineer on the Swift River Valley Railroad.

Thomas J. Barbour, 83, retired engineer, died Nov. 16 in San Francisco, Calif. At one time he was president of the Risdon Iron Works, which later became part of Bethlehem Steel Co.

Albert M. Collier, 70, died in Berkeley, Calif. on Nov. 20. He was graduated in civil engineering from the University of California in 1906, and retired in 1946 after 34 years with the Oakland city engineer's office.

W. Russell Ganser, 55, a maintenance engineer with the Pennsylvania Railroad in Chicago, died there recently.

George F. Roehrig, 62, assistant professor of civil engineering at Lafayette College, died Nov. 10 at Easton, Pa.

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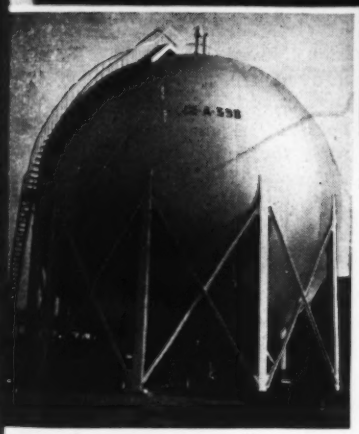

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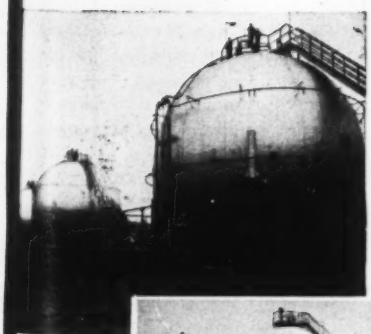

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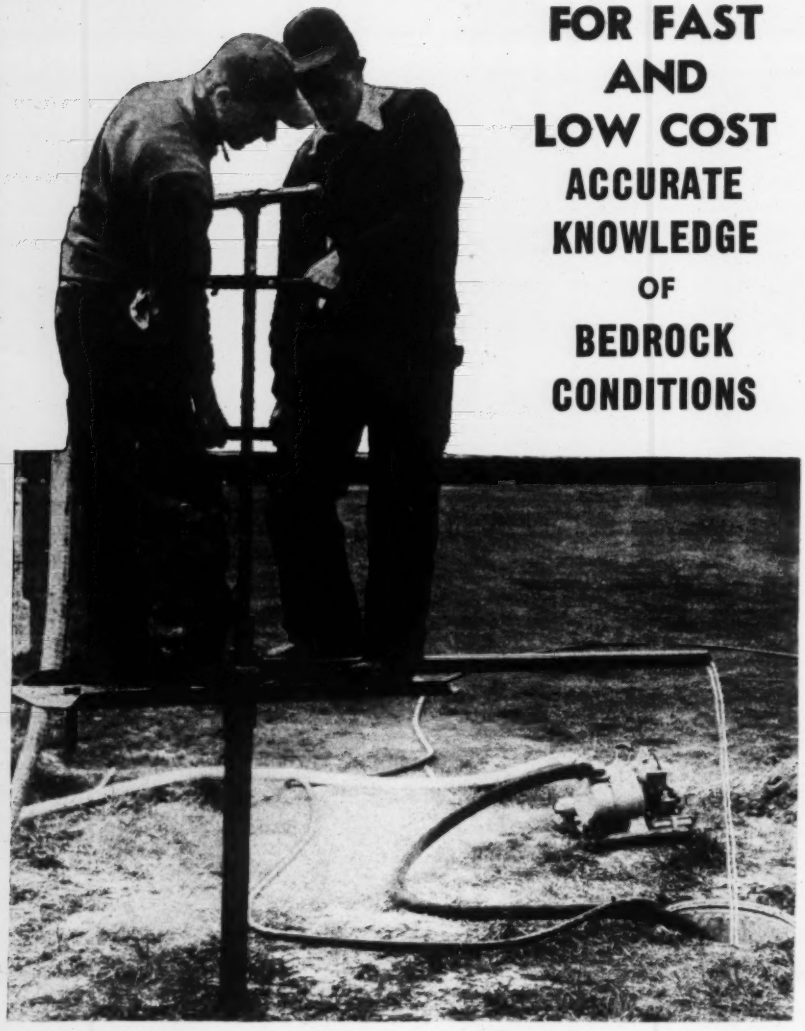

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He was graduated from the University of Michigan in 1917. He served on the faculties of Penn State College and Oklahoma A. and M. before going to Lafayette in 1928.

Charles Leroy Maas, 55, a civil engineer and district sales manager of the elevator division of the Westinghouse Electric Corp., died at Swarthmore, Pa., recently. He was a graduate of Baltimore Polytechnic Institute and Cornell University.

O. P. Allee, 66, civil engineer, Edwardsville, Kan., died Nov. 14. He had done considerable railroad work and at one time was vice-president and manager of the Arkansas Bridge Company.

James M. Dundon, 46, Louisville, Ky., died Nov. 17. He was a graduate of the University of Kentucky and had been employed for several years by the American Creosoting Co. as a civil engineer.

Edward W. Burgess, 68, a consulting and structural engineer of Milwaukee, Wis., died Nov. 7. He was graduated from the University of Wisconsin in 1908 and was a consulting engineer for the A. O. Smith Corp. for 19 years. In 1936, he started his own business and designed many buildings in that section of the country.

Ralph D. Rader, 62, manager of the Portland Cement Information Bureau in San Francisco, Calif., died Nov. 12. He was state engineer of Montana from 1927 to 1936. A graduate of the University of Florida, he served as captain in the Corps of Engineers in France in World War I. He became associated with the Montana state engineering staff in 1920.

FPC Ok's pipe-size change for Texas to N. Y. gas line

Authorization given to the Trans-Continental Gas Pipe Line Co., Inc., of Longview, Texas, last May for construction of a natural gas transmission system extending from Texas to New York City, has been amended by the Federal Power Commission to permit the company to substitute 30-in. pipe for 1,210 miles of 26-in. pipe previously authorized. The 30-in. pipe is to be installed from a point near Opelousas, La., to Chester Junction, Pa.

Deadline for completion of the project, originally set for September 29, 1950, has been extended to April 1, 1951. Estimated cost of the 1,840-mile pipeline, as now proposed, is $191 million.